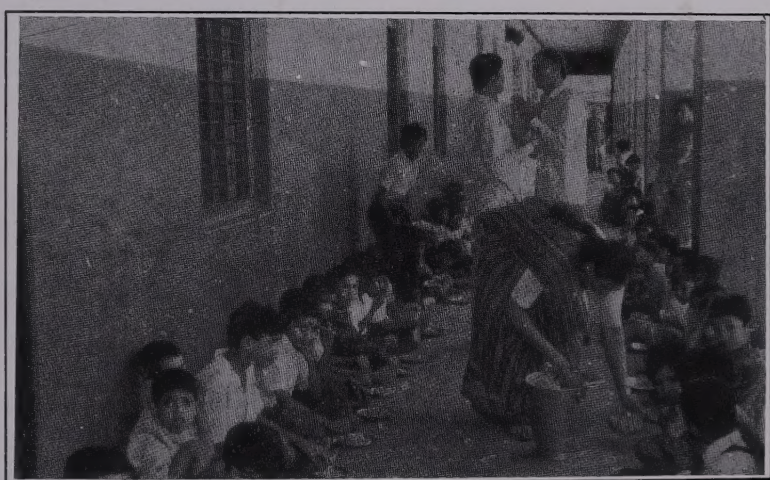
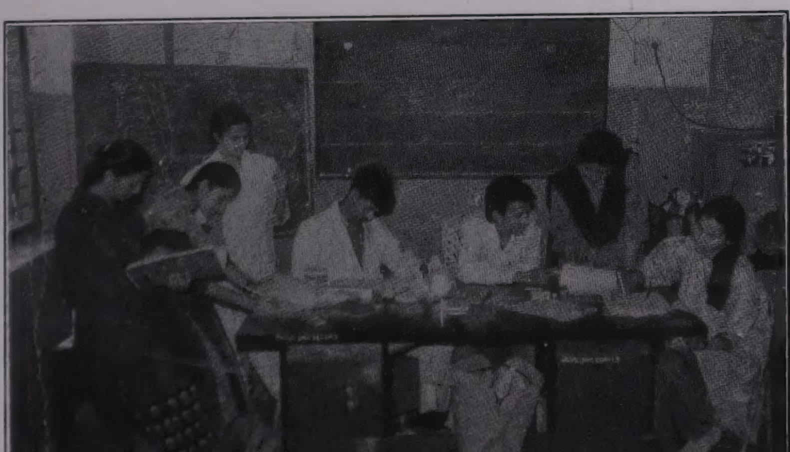
The Pre-Post Impact Evaluation of the Improved Mid-Day-Meal Programme, Gujarat
(1994 - Continuing)

Tara Gopaldas & Sunder Gujral

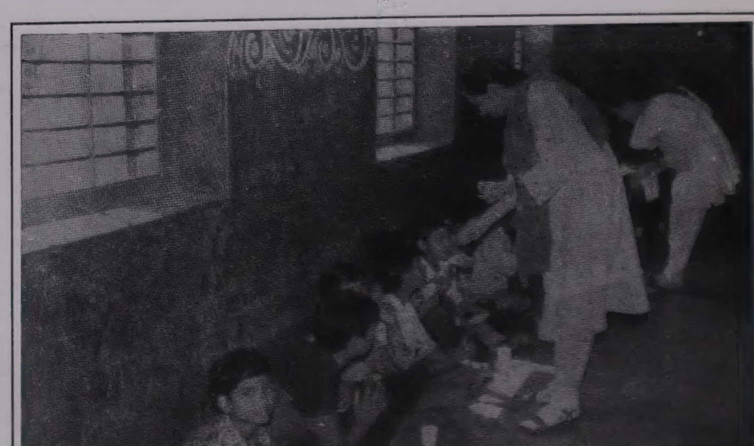
TARA CONSULTANCY SERVICES
Baroda, India
1996



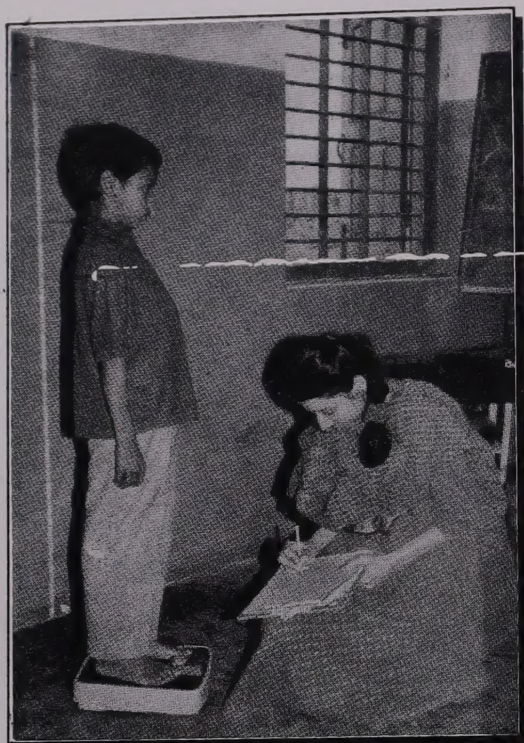
Mid-Day-Meal

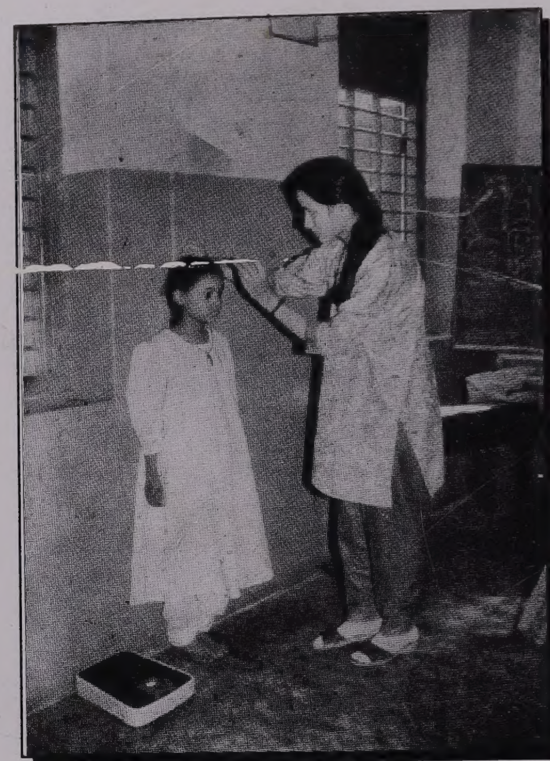


Evaluation Team of TCS



'Improved MDMP (Deworming + Micronutrients, 1994 onwards)





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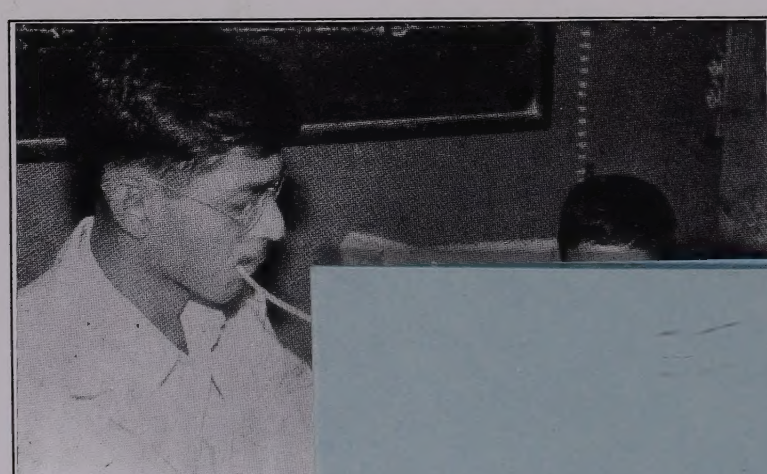

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A REPORT
ON
THE PRE-POST IMPACT EVALUATION OF THE IMPROVED MID-DAY-MEAL PROGRAMME, GUJARAT

(1994 - Continuing)

Tara Gopaldas & Sunder Gujral

TARA CONSULTANCY SERVICES

1996

Title of the Project	The Evaluation of the Process and Impact of the Mid-Day-Meal and School Health Programme in Gujarat, 1993-1996 (30 months)
Contract Number	BIPA 3768
Date of Initiation of the Project	1st August 1993
Chief Collaborator	Dr DAP Bundy Scientific Coordinator of the Scientific Coordinating Centre for the Partnership for Child Development; The WHO Collaborating Centre for the Epidemiology of Intestinal Parasitic Infections; and The Centre for the Epidemiology of Infectious Diseases, University of Oxford, South Parks Road, Oxford OXI 3PS, UK
Funder for this Research Project	The Rockefeller Foundation for Health Sciences, USA

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Date : January, 1996.

Prof Tara Gopaldas
Director
Tara Consultancy Services
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OVERALL EVALUATION DESIGN

The present report is confined to the PRE-POST EVALUATION of Gujarat's "Improved Mid-Day-Meal Programme" (MDMP-GOG) (1994- continuing). It forms one of the four separate components or studies of the OVERALL EVALUATION DESIGN of the said improved programme. The 4 components or studies in sequential order are:

i) FOCUS GROUP INTERVIEWS regarding the 'albendazole, iron and vitamin A package' with the PROVIDERS (the Officials, the Organizers, the Helpers and the Cooks of the MDMP-GOG); the RECEIVERS (the Schoolers of the Mid-Day-Meal); and key influentials (Principals, Teachers and Parents) to elicit their opinions on the addition of the above 'deworming and micronutrient package' to the ongoing Mid-Day-Meal. This guided qualitative study served as an important predictor of acceptance or otherwise of the intended addition. **(The report was submitted in 1994.)**

ii) A PROCESS EVALUATION includes important sequential steps such as procurement, training, coordination, storage, transportation and coverage. **(The report was submitted in 1995.)**

iii) A SENTINEL STUDY on approximately 250 schoolers **not** availing of the Mid-Day-Meal or 'Health Package' but residing in very similar socio-economic and environmental conditions. This study which was confined to Baroda city served as an **independent control** to the large Impact Evaluation (see iv). The major feature of the Sentinel study was the conduct of parasitology of intestinal parasites in the subjects. This permitted us to assess the health and nutritional status of infected and not-infected schoolers. It also permitted us to assess to what extent questioning subjects on history of helminthic infections could serve as a proxy indicator for stool examinations. **(The report was submitted in 1995).**

iv) THE PRE-POST IMPACT EVALUATION OF THE IMPROVED MID-DAY-MEAL PROGRAMME, GUJARAT (1994-CONTINUING) : This impact evaluation was conducted on very nearly 6000 representative schoolers in three study districts, namely, Baroda, Ahmedabad and Rajkot. A stratified random sample of representative schools included 6 large Urban Schools (enrolment of above 500 students); 12 medium (above 250 enrolment); and 12 small (less than 250 enrolment) Rural schools. Impact Evaluation covered Socio-economic and Environmental characteristics; participation in the MDMP; receipt of the Health Package Inputs and KAP regarding them; and the impact, if any, on anthropometric, clinical, biochemical, and intestinal parasitic status. **(This report, 1996).**

HIGHLIGHTS OF THE IMPACT EVALUATION

(1) The school health package, integrated into the ongoing MDMP was implemented by the GOG in Gujarat State (1994-continuing).

(2) Nearly 3 million primary schoolers in all the 19 districts of Gujarat were under the programme.

(3) One round of the health package included a six-monthly dose of 400 mg albendazole tablet, six-monthly dose of 200,000 IU vitamin A and one tablet of ferrous sulphate (60 mg elemental iron) daily for 85 days in a school term.

(4) Purchase of the health inputs by the concerned Government officials and supply efficiency was 100%.

(5) The impact evaluation was conducted on 6000 schoolers in purposively selected three districts of Gujarat State.

(6) 71% to 79% of Urban and 50% to 67% Rural schoolers received the health inputs. Higher figures were obtained for the receipt of ferrous sulphate tablets.

(7) The cost of two rounds of dosing/year of the health package was Rs.10.56 (US $0.35).

(8) The impact following a minimum of one round of health inputs was encouraging.

(9) The prevalence of intestinal parasitic infections significantly reduced from 71% to 40%.

(10) Haemoglobin levels significantly improved from 10.7± 0.04 to 11.9 ± 0.04 g/dl and 10.5 ± 0.04 to 11.7 ± 0.04 g/dl in boys and girls respectively.

(11) The prevalence of vitamin A deficiency ocular signs significantly decreased from 48% to 22%.

(12) Growth improved significantly. More schoolers were in the normal category by Body Mass Index (BMI 15.0) at the Resurvey versus the Baseline survey (12% vs 7% younger and 34% vs 24% older age groups).

(13) Significant reductions were recorded in diarrhoeal cases in the past two months.

(14) Above 70% schoolers perceived that they felt physically more fit after taking the health inputs than before.

(15) This simple, sustainable and feasible 'School Health Package' has already paid back a high dividend.

(16) It is strongly recommended that the 'Improved Gujarat MDMP' model may be taken to other States and UTs of our country.

Chapter One

INTRODUCTION

CURRENT STATUS OF THE MID-DAY-MEAL PROGRAMME (MDMP) IN INDIA

The Prime Minister of India launched the All-India MDMP from August 15th (India's Independence Day), 1995. India's 22 States and 10 Union Territories (UTs) will now launch the MDMP with Central financial assistance. About **40 million** primary schoolers (6-15 years) will be covered in 1995-'96. By 1997 the MDMP will cover about **160 million schoolers**. On a global scale, this probably represents one of the greatest opportunities for global partners, funders and developmental agencies to come together in the improvement of the health and micronutrient status of this huge mass of under-privileged schoolers in this one sub-continent of the world.

LESSONS TO BE LEARNT FROM GUJARAT'S UNIQUE AND INNOVATIVE MDMP WHICH DELIVERED DEWORMING, IRON, IODINE AND VITAMIN A IN ADDITION TO THE MDM TO 3 MILLION SCHOOLERS FROM 1994-CONTINUING

A decade's research at M S University of Baroda on schoolers in **Gujarat's** MDMP, clearly established that the nutritional status of the schooler (6-15 years) was **worse** than that of the **pre schooler**. Further, **older** the schooler (11-15 years) the **worse** was his/her condition. Overall the nutritional, health and intestinal parasitic status of these under-privileged slum-dwelling schoolers was deplorable. The greatest dietary gaps **inspite of the MDMP** were with respect to **iron and vitamin A and not calories or protein**. Intestinal helminths and protozoal infections were seen to seriously interfere with growth and the utilization of iron and vitamin A. Iron deficiency was negatively correlated with physical work capacity and certain areas of cognition. These functional areas showed improvement on supplementation. Vitamin A deficiency was associated with significantly more episodes of Upper Respiratory Tract (URI) infections. Vitamin A supplementation helped control these episodes. A clear beneficial synergism in delivering a package of anthelmintic, iron and vitamin A supplementation was established.

Several intervention studies among under-privileged schoolers of Baroda followed (Saxena 1980; Gautam 1980; Raghavan 1982; Ganguli 1982; Kanani and Gopaldas 1983; Gopaldas et al 1983a; Kanani 1984; Pant 1986; Pant and Gopaldas 1986; Kashyap and Gopaldas 1987a; Pant and Gopaldas 1987; Bakshi 1989; and Bakshi and Gopaldas 1989). In essence a package of health inputs consisting of a single dose of albendazole (400 mg), vitamin A tablets (200,000 IU), and Folifer tablets (20 to 60 mg elemental iron) delivered at the beginning of each school term succeeded in bringing down the load of intestinal helminths, increasing the haemoglobin levels by >1 g/dl, and reducing the clinical signs of vitamin A deficiency. The cost of this school health package was only about Rs.15 or about 50 US Cents/child/year.

The Government of Gujarat had the **vision to include the above mentioned "anthelmintic + micronutrient package" as an integral part of its MDMP from 1994**. Iodized salt was routinely used in the MDMP.

BACKGROUND OF THE MID-DAY-MEAL PROGRAMME (MDMP) IN GUJARAT, WESTERN INDIA

The MDMP has been in existence in India since the sixties. Gujarat started a school feeding programme in 1962. The GOG has been making successively higher financial allocations for the MDMP in its 5-Year-Plans. The State has 19 districts with a strong MDMP since 1985, in its Urban, Rural and Tribal settings. The programme has been considered important enough to function through an **autonomous** Commissionerate of MDMP under the Chairmanship of the Chief Minister of the State. The Commissioner, MDMP, is usually a high ranking officer of the Indian Administrative Services (IAS) of the rank of Additional Chief Secretary. He/She coordinates the policies/inputs of five State departments, namely, Education, Revenue, Health, Civil Supplies, and Building & Water Supplies with reference to the MDMP. The MDMP has a strong organizational structure of a Commissioner, Director and Assistant Directors at the State capital. At the District level it has Deputy Collectors and Mamlatdars (for Urban/Rural/Tribal areas) to oversee the procurement of food commodities, their storage, distribution, financial audit and overall administration. Eighty thousand Organizers (college or school graduates) and their Cooks and Helpers are responsible at the school-level to cook and serve the hot meals (generally a cereal-pulse preparation) to the schoolers in the MDMP. **Iodized salt** is routinely used in the MDMP. **In 1994**, the MDMP covered nearly 3 million schoolers. Its **annual** budgetary allocation was Rs.920 million or about US$31 million (exchange rate of Rs.30.00 = US$1) (Shah 1988, Yajnik 1984, Annual Plan 1993-1994, Mid-Day-Meal Programme 1992-1993).

According to the 1991 Census, Gujarat has a total population of 35 million. The primary schoolage population is about 18% of the total population or about 6.3 million. Of these, about 5 million are enroled in the free Rural and Urban primary schools and approximately 3 million partake of the Mid-Day-Meal.

BACKGROUND OF THE SCHOOL HEALTH PROGRAMME IN GUJARAT

A defunct School Health Programme does exist on paper. There are about 100 odd functionaries located at the Primary Health Centres of the State who are expected to carry out the School Health Programme. The MDMP Commissionerate may be successful in transferring these functionaries to the MDMP.

It is indeed ironic that Committees set up for School Health **preceeded** those for the Mid-Day-Meal. Yet, the recommendations made by several National Health Committees, namely, the Bhore Committee (1946); the Mudaliar Committee (1954); and the School Health Committee (1961) to improve School Health have received scant attention in Gujarat until 1992.

STEPS TAKEN BY THE GOVERNMENT OF GUJARAT (GOG) TO INCLUDE THE ANTHELMINTIC + MICRONUTRIENT PACKAGE AS AN INTEGRAL PART OF THE MDMP (1992-continuing)

i) From 1992, the Commissioner, MDMP, GOG, initiated a dialogue with Tara Consultancy Services (TCS) as to how the ongoing MDMP could be improved.

ii) In 1993, the Commissionerate, MDMP, GOG obtained the sanction from the Planning Commission to add on the above "School Health Package" to its MDM.

iii) In 1994, the Chief Minister (who is also the Chairman of the MDMP), approved the new activity and annual budget of Rs.50 million (about 1.7 million US dollars). The State Legislative Assembly subsequently approved the activity and budget.

iv) In 1994, the MDMP procured the necessary amounts of albendazole tablets, iron tablets and vitamin A capsules to dose approximately 3 million children in the MDMP.

v) The MDMP implementors were trained in the dosing schedules by the State Health Department and NGOs.

vi) The dosing rounds (continuing) commenced in July/August, 1994.

vii) The MDMP Commissionerate and its Technical Advisory Committee meet regularly to review and strengthen the programme further.

HIGHLIGHTS OF THE EARLIER TCS-PCD EVALUATIONS

RESULTS OF THE FOCUS GROUP INTERVIEWS (1994)

Focus Group Interviews (FGIs) or guided group discussions were held with government officials implementing the programme, principals, teachers, parents, and the schoolers **before** the School Health Inputs Programme started. The purpose was to elicit opinions on the intended programme. The MDMP officials opined that most of the schoolers suffered from worms and nutritional deficiencies. Many schoolers stated they passed worms, felt tired, and could not see properly in failing light. Parents were generally not aware of such problems in their school-going children. All (Providers and Receivers) were very positive about the intended programme. Principals, teachers and parents said they would help in the Dosing Rounds and **would see to it** that the tablets or "golis" were consumed.

RESULTS OF THE PROCESS EVALUATION

Full credit must be given to Shri S Chandrasekhar, IAS, Commissioner MDMP upto end 1993, for his vision and unstinting efforts to improve the MDMP in Gujarat by integrating the "anthelmintic + micronutrient package" into the ongoing MDMP; and to Shri AR Banerjee, IAS, Additional Chief Secretary & Commissioner, MDMP-Gujarat and his team for the operational planning and execution of the School Health Inputs Programme (1994-continuing).

The MDMP Commissionerate worked very hard from early 1994 to make the 'School Health Inputs' programme a success. It procured the necessary tablets of albendazole (400 mg), ferrous sulphate (60 mg elemental iron), and vitamin A capsules (200,000 IU) to dose nearly 3 millon primary schoolers in the 19 districts of Gujarat. Iodized salt was used routinely in the cooked meals. The pharma companies transported the inputs to the district or taluka head quarters (HQ) where they were stored. Thereafter, the Officials and Organizers of the MDMP collected their quota and dosed the schoolers as prescribed by the Expert Technical Committee set up by the MDMP. The chain-method of the Chief District Health Officer (CDHO) training (dosing/benefits/transient side effects), the Deputy Collectors and Mamlatdars who in turn trained the Organizers, who in turn trained the Helpers/Cooks was found to be highly cost effective and

efficient. The procurement, logistical delivery and receipt by the schoolers ranged from 90-100%. Where necessary, the stocks were stored in the Principal's or Organizer's lockable office cup-board. The shelf-life of the inputs was also well beyond 2 years. Hence, provided they were kept in a dry and dark (for vitamin A) place, they were absolutely safe for further use. What was very commendable about this programme was the enthusiastic acceptance by the Providers (MDMP Commissionerate assisted by State Health Department, State Education Department, and some voluntary agencies) and the Receivers (the Schoolers). The Community, Parents, Principals, Teachers and the Schoolers were all for it.

Chapter Two

OBJECTIVES

FOCUS OF THIS IMPACT EVALUATION REPORT

One may wonder what new information is going to be offered by the last and longest of the TCS-PCD reports? The data presented here related to approximately 6000 Urban and Rural representative schoolers drawn from 3 study districts (please refer to the Chapter on RESULTS) analyzed in detail to answer programmatic questions as under:

i) What were the socio-economic and environmental characteristics of the Schoolers? What was their workload out of school?

ii) Who were the major school beneficiaries of the Gujarat MDMP and the 'anthelmintic + micronutrient package'?

iii) What were the positive and negative KAP regarding the 'anthelmintic + micronutrient package'?

iv) Which of the inputs i.e. albendazole, iron, and vitamin A were most liked and most widely received by the schoolers? Did the distance of the school from the village make a difference?

v) Who were the best/worst sources of information regarding the 'anthelmintic + micronutrient package'?

vi) What was the improvement in growth by age, gender and location?

vii) What was the reduction in prevalence of intestinal parasites by age, gender and location?

viii) What were the improvements in ocular vitamin A status by age, gender and location?

ix) What were the improvements in haemoglobin status by age, gender and location?

Chapter Three

METHODS AND MATERIALS

Two Rounds of Surveys were Conducted :

(a) Baseline survey : It was conducted before the implementation of the health package (comprising of albendazole, vitamin A and ferrous sulphate, to schoolers) to record their existing nutritional status in terms of nutritional anthropometry, vitamin A status by ocular signs, iron deficiency by haemoglobin levels and intestinal parasitic status by the schooler's own observation of his feces.

(b) Resurvey : This was carried out six to nine months after the implementation of the health package (at least one round of dosing completed) to schoolers to record improvements if any, (i) in iron status as indicated by haemoglobin levels; (ii) reduction, if any, in the prevalence of intestinal parasitic infections; (iii) and improvement in vitamin A status; and (iv) in growth.

Sampling Procedure

Selection of Districts :

Gujarat State has 19 districts (Fig 1a) with a total population of 35 million. The primary school age (6-15 years) population enroled in the first seven grades approximates 5 million. For the present evaluation, three districts viz Baroda, Ahmedabad and Rajkot (Fig 1b) of the State were purposively selected having access roads to the Rural and Tribal schools and together representing 25% of the State's total population.

Selection of Talukas (large Rural administrative units covering 300,000 total population) :

There are 12, 7 and 13 Talukas in Baroda, Ahmedabad and Rajkot districts respectively. Districtwise lists were made of the Talukas and their distance from their respective district HQ. The Talukas (excluding the Urban-Taluka) were stratified by distance, namely, those within and above 50 km distance from their District HQ. Then one Taluka from each stratum was randomly selected. This provided two Talukas per district. All the three Urban-Talukas (one of each district) were included in the sample. Hence, the study sample consisted of 6 Rural-Talukas and 3 Urban-Talukas (Figure 1b). Details of the sampling procedure is depicted in Figure 2.

Selection of Schools :

All the primary schools in the sampled Rural-Talukas and in the Urban-Talukas where the MDMP was in operation were listed. For selection of Urban schools, a complete list of schools by enrolment was prepared. From this, the schools having a student enrolment of above 550 were listed out. From this list, 2 schools (one of boys and one of girls where co-education did not exist) per district were randomly selected. For the Rural-Taluka schools, the school lists

Note : A Taluka comprises a Rural or Urban agglomeration of 100,000 to 300,000 total population. If Rural, it may have anywhere from 1000 to 3000 villages.

Figure 1a

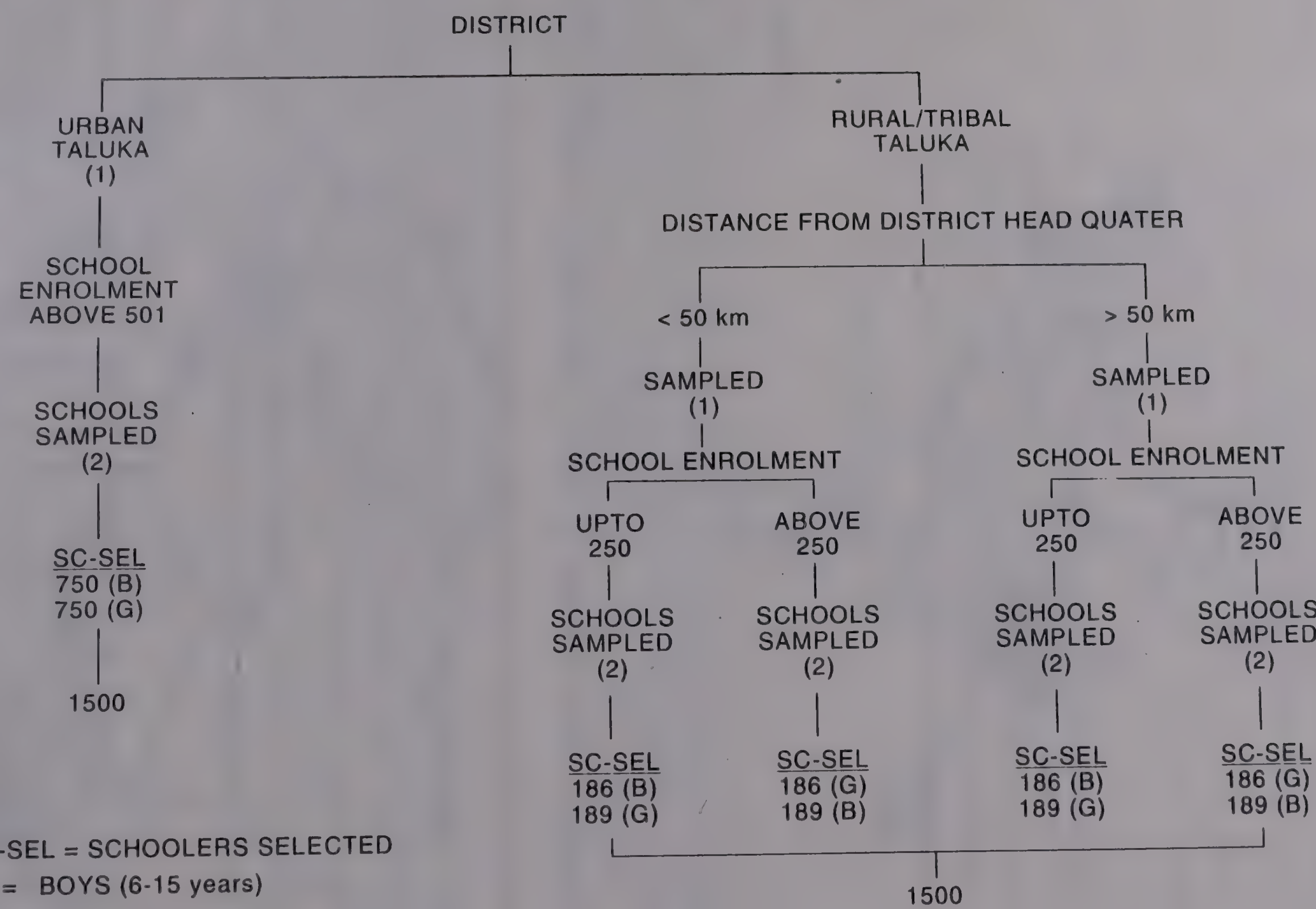
Map of India showing Gujarat State

Figure 1b

Map of Gujarat State showing the three study districts and the study Talukas

Figure 2

Sampling Procedure for the three study districts



SC-SEL = SCHOOLERS SELECTED

B = BOYS (6-15 years)

G = GIRLS (6-15 years)

were stratified by school size of less than or above 250 schoolers. Then two schools from each stratum were randomly sampled. Thus four schools per Taluka were sampled.

In all 10, namely, 2 Urban and 8 Rural representative schools per district formed the study universe. Hence 30 schools in 3 study districts formed our total sample.

Selection of Schoolers for the Baseline survey :

In order to sample schoolers of 6-15 years, 10 age categories were used (6, 7, 8, 9, 10, 11, 12, 13, 14, 15 years). From the sampled Urban schools, 25 schoolers and from the sampled Rural schools, 6-7 schoolers per age category were enroled for the Baseline evaluation based on the schooler's and his/her parent's cooperation. Thus from two Urban schools 500 (250 schoolers per school) and from 8 Rural schools, 500 schoolers (63 schoolers per school) were sampled to arrive at a total sample of 1000 schoolers per district or 3000 for the 3 study districts.

Selection of Schoolers for the Resurvey :

As far as possible, schoolers covered in the Baseline survey were enroled. The agewise size of the sample was maintained at 300 schoolers per age group (150 boys + 150 girls) by enroling new schoolers (not covered in the Baseline survey) from the same schools (schools selected for Baseline survey). In total 3000 schoolers were re-surveyed.

Questionnaires, Instruction Manual and Survey Kit

Three sets of questionnaires were constructed for the Baseline survey as well as for the Resurvey. The questionnaires were pretested and precoded.

i) A **green** coloured questionnaire was used to collect data on the schooler's socio-economic profile,

ii) A **yellow** coloured questionnaire was used to collect data on the schooler's participation in the MDMP and

iii) A **pink** coloured questionnaire was used to collect data on the schooler's nutritional and health status.

An Instruction Manual

An instruction manual was prepared for "ready use" by the field investigators. This was considered necessary so that the terms/definition of the various morbidities/questions had the same meaning for all the members of the investigating team.

The contents of the manual were :

- general guidelines for data collection
- instructions to code the data definitions/description of the terms used in the questionnaire
- details of the procedures to be followed for anthropometric measurements and blood sample collection for haemoglobin estimations.

Survey Kit :

A survey kit was prepared which was carried to the field by each investigator. Whenever the team had to be in the field for more than a day an extra kit was prepared in case any item broke or got finished.

The contents of the kit were :

(1) Questionnaire

(2) Instruction Manual

(3) Clip-board, pencil, eraser, sharpner, stapler, ruler and torch

(4) Field guide to the detection and control of xerophthalmia; (second edition, Sommer, WHO, 1982)

(5) Anaemia Recognition Card; Voluntary Health Association of India

(6) Sample of tablets -

(a) Albendazole tablet. . . 2 (200 mg each)

(b) Vitamin A capsule . . 1 (200,000 IU each)

(c) Iron tablets . . . . 50 (Ferrous sulphate 200 mg each)

(7) Weighing scale (Krups weighing scale)

(8) Height meter

(9) Micro-pipette, lancets, alcohol, ammonia, acetone, cotton swabs, Whatman filter paper no.1, butter paper and transparent polythene packets.

Investigating Team

The investigating team consisted of Master's degree holders (in Nutrition/Social Work and a Medical Internee appointed on an ad hoc or permanent basis. A permanent staff member acted as the leader of the team. The team leaders were responsible for keeping a day-to-day record of the number of schoolers covered (agewise and sexwise); meeting the school principal to get his/her permission to use the physical facilities of the school and for enroling schoolers for the study; for recording birth-dates of the enroled schoolers from the school registers; and for recording school attendance (for the previous year) of the enroled schoolers.

Net-working Partners

Since the project covered three study districts viz Baroda, Ahmedabad and Rajkot, for the districts other than Baroda, net-working arrangements were made with the Head of the St.Xavier's College, Ahmedabad and the Head of the Home Science College, Saurashtra University, Rajkot.

Training of the Net-working Partners and the Investigating team

Training of the net-working partners was conducted once before the Baseline survey commenced at Baroda and again before the Resurvey commenced at Ahmedabad.

The training included familiarization with the survey kit, questionnaires and manual. The trainers explained to the trainees, question by question how the data were to be collected and how the manual was required to be used for understanding the definitions etc. The investigating team was given a demonstration on anthropometric measurements, clinical examination for vitamin A deficiency ocular signs, for iron deficiency anaemia (IDA), and withdrawl of blood for haemoglobin estimations.

Implementation of the Health Inputs Programme

The distribution of health inputs (anthelmintic + micronutrients viz vitamin A and iron) to schoolers was carried out by the MDMP-GOG. The dose pattern and the cost of the health inputs per schooler per year is detailed below:

Dose Pattern and Cost of the Health Inputs

Health Inputs	Dose Pattern	Total Schoolers Covered[1] (million)	Cost[2] (Rs.) per Two Rounds per School Year per Schooler
Anthelmintic :			
Albendazole (200 mg)	1 + 1 per 6 months	2.835	6.19
Micronutrient :			
Vitamin A (2 lakh IU)	1 per 6 months	2.835	2.95
Ferrous sulphate (60 mg elemental iron)	1 per day for 85 days along with the MDM	2.835	1.42
			10.56 (US$ 0.35)

Source : [1] The figure for the total number to be covered was taken from the Annual Plan of the Commissionerate of MDMP, 1993-94.

[2] Commissionerate, MDM, Gandhinagar, Gujarat State for costs (1994).

Data Collection

For the Baseline survey and the Resurvey, data were collected on :

(a) Socio-economic characteristics of the schoolers (house construction, water and toilet facilities, amount of physical work done by them in a day, religion and caste),

(b) Nutritional and Health status (nutritional anthropometry, vitamin A deficiency eye signs, haemoglobin estimation and intestinal parasitic infections as stated by them).

The Baseline survey was conducted during 1993-94 and the Resurvey during 1994-95.

Details of the Procedures Used

Anthropometric measurements : The index schooler was weighed with minimum clothing to the nearest 0.5 kg using a Krups weighing scale (Jelliffe 1966). The weight was taken twice and average weight was computed and recorded. The scale was adjusted to zero each time the schooler was weighed.

A height meter was used to measure height of index schooler to the nearest 0.1 cm. The height was measured twice. The average was computed and recorded.

Clinical : All schoolers were examined for preclinical and clinical ocular signs of vitamin A deficiency (Sommer 1982).

Vitamin A deficiency : Vitamin A deficiency was detected using the "Field Guide to the detection and control of Xerophthalmia" (Sommer 1982). The ocular signs of vitamin A deficiency were classified as follows :

XN	=	Night-blindness
X1A	=	Conjunctival xerosis
X1B	=	Bitot's spot
X_2	=	Corneal xerosis
X_3A	=	Corneal ulceration/Keratomalacia.

Haemoglobin estimation : The Cyanmethaemoglobin procedure as described by Oser (1976) was used for haemoglobin estimations. The blood samples were analysed either in the field by a battery operated colorimeter or brought to a local pathology laboratory for analysis.

In the latter case Cyanmethaemoglobin method as modified by NIN (1974a) using filter paper technique was employed and haemoglobin estimations were done by a well recognized pathology laboratory in Baroda.

Data processing and analysis

Data Entry, Verification and Validation

A special Data-Entry-Package was developed to enter, verify and validate the data. This package was designed to check the pre-specified minimum and maximum limits of each item of data. It also checked the logical consistency of the responses to a question with responses to other related questions.

Data were entered as well as verified under the control of this package. During verification the data were entered for a second time and it was matched with the data entered earlier. Any mismatch was rectified. Data set was validated both during entry and verification.

Tabulation and Statistical Analysis

SPSS was used for tabulation and statistical analysis. SPSS commands were written to describe all variables and specify missing values. SPSS commands to produce tables were written and tested. Similarly SPSS commands were written to do appropriate statistical analyses. Finally when the complete data set was ready, Tables were produced and Statistical Analyses was carried out. The graphical representation of data in the form of Bar, Pie and Line Charts was done by using Harvard Graphics. All tests were considered significant at $p<0.05$.

Chapter Four

FINDINGS

This chapter is organized in eight sections (please see later on). The data presented in this report relate to 2872 in the Baseline survey and 2964 schoolers in the Resurvey (Table 1). Enrolment in Class One is usually beyond the age of six years. Most primary schoolers also leave before they complete their Seventh Class (highest class at the primary level). Hence, it was not possible to enrol the required quota (300 schoolers per age category) of subjects at the extreme age categories.

Table 1
Agewise and Sexwise total number of schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts

AGE (Years)	Baseline			Resurvey		
	Boys	Girls	Total	Boys	Girls	Total
	N	N	N	N	N	N
6	99	107	206	167	175	342
7	149	148	297	165	168	333
8	155	158	313	187	171	358
9	163	168	331	169	171	340
10	153	178	331	155	180	335
11	164	177	341	154	161	315
12	187	196	383	180	194	374
13	152	191	343	144	169	313
14	104	114	218	111	85	196
15	69	40	109	36	22	58
6-15	1395	1477	2872	1468	1496	2964

Age : 6 years = 5 years & 6 months to 6 years & 5 months
7 years = 6 years & 6 months to 7 years & 5 months and so on

We would urge the reader to bear in mind that the clear cut results that emerge in carefully controlled large community trials do not usually follow in full fledged Government run programmes. Hence, if the Impact Results on a representative sample, show significant improvement, it would certainly indicate that the said programme was implemented and managed well. An attempt has been made to examine the results of each section in terms of programme implications. Sections are as under:

Section One : The socio-economic, housing, MDMP-participation, and other related characteristics of the study population.

Section Two : Prevalence and severity of intestinal parasitic infections in the study population.

Section Three : The overall receipt and impact of the School Health Package (anthelmintic + micronutrient supplementation) on the schoolers.

Section Four : Impact of the School Health Package on the Haemoglobin status of the schoolers.

Section Five : Impact of the School Health Package on the Intestinal Parasitic status of the schoolers.

Section Six : Impact of the School Health Package on the Vitamin A status of the schoolers.

Section Seven : Impact of the School Health Package on the Anthropometric status of the schoolers.

Section Eight : Perceived Benefits by the schoolers with respect to the School Health Package.

SECTION ONE : THE SOCIO-ECONOMIC, HOUSING, MDMP-PARTICIPATION, AND OTHER RELATED CHARACTERISTICS OF THE STUDY POPULATION

Section One deals with :

(1) Enrolment of the schooler by caste;

(2) Housing and toilet facilities of the schooler;

(3) Manual work done by the schooler;

(4) Participation in the MDMP by the schooler; and the

(5) KAP of the schooler regarding the MDMP.

(1) Enrolment of the schooler by caste :

In both the surveys (Table 2) **a majority (about 85%) of the schoolers belonged to the socially Backward Classes (BC) or Scheduled Class or Tribes (SC/ST)**. The overwhelming school enrolment was among the poorest of the poor schoolers (BC/SC/ST). This is in consonance with the overall policy of the Government of Gujarat (MDM Scheme, 1984 and the Annual Plan of the MDMP, Government of Gujarat, 1993-94). Our findings corroborate those of Shah (1988) in his evaluation of the MDMP in Gujarat, wherein he noted that the neediest of the schoolers participate in the MDMP. Data from the MDMP-Gujarat, indicate that nearly 5 million schoolers or about 14% of Gujarat's total population, are enroled in her free Urban and Rural schools. The average daily attendance is stated to be 4.5 million (90% of enrolment). In 1994-continuing, nearly 3 million schoolers or about 60% of those enroled, and about 70% of those attending school daily, **do** participate in the MDMP (Annual Plan of the MDMP-1993-94).

(2) Housing and toilet facilities of the schooler

Regardless of caste categories, four-fifths of the schoolers lived in their **own houses** which were mainly of concrete. However, only one-half of them had a toilet facility at home. All had a water source within one kilometre distance from their home (Table 2).

(3) Manual work done by the schooler

Over 80% schoolers in our study population did some manual work. The majority (80%) of the schoolers put in less than 1 to 2 hours of manual work in household chores/or in out-of-home activities. The remaining 20% put in 2 to 4 hours of hard physical work every day (Table 2).

(4) Participation in the MDMP by the schooler

Over 70% of Urban and Rural schoolers participated in the MDMP. A majority of these, especially the Rural schooler was a regular participant in the MDMP (participation of >15 feeding days/month) (Table 3).

The MDMP-participation figures obtained in our surveys tally with the figures given in our Focus Group Interviews (FGI 1994); and with those of the GOG (MDMP-GOG 1992-93). The major reasons for non or irregular participation in the MDMP was (i) Caste consciousness and, (ii) Poor quality of the meal (FGI 1994, Shah 1988).

Table 2
Socio-economic characteristics of the schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts

Characteristics	Baseline		Resurvey	
	N	%	N	%
Caste				
Backward Class (BC)	1909	66	1940	65
Scheduled Class (SC)	197	7	287	10
Scheduled Tribe (ST)	335	12	324	11
Others	431	15	413	14
Total	2872	100	2964	100
Own house				
Yes	2354	82	2385	80
No	518	18	579	20
Total	2872	100	2964	100
Construction of house				
Kutcha (Mud plastered)	436	15	297	10
Semi Pucca (Mixed)	727	25	785	26
Pucca (Concrete)	1709	60	1882	63
Total	2872	100	2964	100
Toilet facility				
Yes	1367	48	1461	49
No	1505	52	1503	51
Total	2872	100	2964	100
Distance between the water source and home				
< 1 km	2850	99	2950	100
1-3 km	18	1	7	0
> 3 km	4	0	7	0
Total	2872	100	2964	100
Child does manual work				
Yes	2357	82	2352	79
No	515	18	612	21
Total	2872	100	2964	100
Duration of manual work				
< 1 hr	1047	44	992	42
1-2 hrs	851	36	938	40
2-4 hrs	303	13	255	11
> 4 hrs	156	7	167	7
Total	2357	100	2352	100

Caste : Categorization was based on caste list of Labour, Social Welfare and Tribal Development Board of Gujarat Government Resolution No BCR : 1078 - 13734 - H, April 1978

(5) KAP of the schooler regarding the MDMP

Since the success of a programme depends largely on the awareness of the beneficiaries regarding the programme benefits, the schoolers' knowledge about the benefits of the MDMP was evaluated. They were considered to be having adequate knowledge if they could state a minimum of three benefits, namely, (i) makes me attend school regularly, (ii) keeps me free

Table 3

Participation of the schoolers (6-15 years) in the Mid-Day-Meal Programme (MDMP) in the Baseline and Resurvey covering the three study districts

Characteristics	Baseline						Resurvey					
	Urban		Rural		Total		Urban		Rural		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Schooler's participation in MDMP												
Yes	1116	77	1069	75	2185	76	1091	71	1042	73	2133	72
No	333	23	347	25	680	24	444	29	387	27	831	28
Total	1449	100	1416	100	2865	100	1535	100	1429	100	2964	100
Regular	805	72	841	79	1646	75	670	61	733	70	1403	66
Irregular	311	28	228	21	539	25	421	39	309	30	730	34
Total	1116	100	1069	100	2185	100	1091	100	1042	100	2133	100

Regular = Participation for 15 days or more in the past one month
Irregular = Participation for less than 15 days in the past one month

Table 4

Schooler's (6-15 years) knowledge regarding the benefits of the Mid-Day-Meal (MDM) in the Baseline and Resurvey covering the three study districts

Characteristics	Baseline						Resurvey					
	Urban		Rural		Total		Urban		Rural		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Knowledge regarding benefits of MDM												
Adequate	624	43^a	446	31^b	1070	37^a	385	25^b	384	27^a	769	26^b
Inadequate	831	57^b	971	69^c	1802	63^b	1150	75^c	1045	73^b	2195	74^c
Total	1455	100	1417	100	2872	100	1535	100	1429	100	2964	100
Source of knowledge												
Teacher	289	46	249	56	538	50	223	58	208	54	431	56
Parents	177	28	77	17	254	24	97	25	82	21	179	23
Friends/ classmates	50	8	22	5	72	7	7	2	2	1	9	1
Other	108	17	98	22	206	19	58	15	92	24	150	20
Total	624	100	446	100	1070	100	385	100	384	100	769	100

Adequate = Stated a minimum of three benefits
Inadequate = Stated less than a minimum of three benefits
Other = Research Staff of Tara Consultancy Services and Staff of the Mid-Day-Meal Centre
Figures under each matching head having different superscript in the same row between the surveys are significantly different from each other
Figures having different superscript in the same column are significantly different from each other

from being hungry at school and (iii) gives me strength to work and play etc. Table 4 shows that the majority (over 60%) of the schoolers in both the Baseline survey and the Resurvey lacked knowledge although about 70% schoolers participated in the programme (Table 3). This is surprising as in the FGIs (FGI 1994) similar groups of schoolers could vocalise the benefits along with their parents who very enthusiastically stated that the MDM had improved their children's well being.

Teachers appeared to be the main source of knowledge followed by the parents (Table 4).

SECTION TWO : PREVALENCE AND SEVERITY OF INTESTINAL PARASITIC INFECTIONS IN THE STUDY POPULATION

Section Two includes :

(1) Prevalence of intestinal parasitic infections in the schooler;

(2) Intensity of intestinal parasitic infections in the schooler;

(3) Intestinal parasitic infections and environmental factors; and

(4) Programme implications.

An individual section has been devoted to the prevalence and intensity of intestinal parasitic infections in the under-privileged schooler. The epidemiological studies of Bundy and Guyatt (1995), Savioli et al (1992), Warren et al (1993) and Latham et al (1990) have clearly shown that the school-age population is the **most infected segment in the total population**. The grave public health significance of this has **not** been sufficiently realized by Policy Makers or Programme Implementors.

(1) Prevalence of intestinal parasitic infections in schooler

The schoolers were shown a picture of the most common intestinal worms namely round worm (Ascaris lumbricoides), hook worm (Ancylostoma duodenale), whip worm (Trichuris trichuria) and thread worm (Enterobios vermicularis). They were then asked whether they passed any of these worms in their feces.

We however, were fully aware that it may not be easy for the schooler to distinguish worm/s (even when expelled in adult form) with the naked eye from the food fibers etc present in his/her feces. This is because the length of the worms (other than round worm) is microscopic ranging from 2 mm (male) to 12 mm (female) for thread worm; and 3 cm (male) and 5 cm (female) for whip worm. The length of the male round worm, by way of contrast, is 15 to 25 cm and that of the female is 25 to 40 cm (Chatterjee 1981). Detailed questioning of the schooler however, was done wherever possible. Anal pruritis was taken as indicative of thread worm infection.

The overall prevalence of intestinal parasitic infections was **40%** (Table 5). Among the infected schoolers, the highest prevalence (**79%**) was for thread worm and the lowest (**3%**) for whip worm. Since anal pruritis was considered as indicative of thread worm prevalence and since poor personal hygiene which is very common among Rural and Slum schoolers, can cause this condition, this high figure may be considered as an over estimation of thread worm infection.

Table 5
Prevalence of intestinal helminthic infections as stated by schoolers (6-15 years) in the Baseline covering the three study districts

Variables	Total		Round-worm		Hook-worm		Whip-worm		Thread-worm	
	N	%	N	%	N	%	N	%	N	%
All schoolers (2864)	1141	40	140	12	117	10	38	3	905	79
By age group (years)										
6-10 (1473)	633	43	89	14	80	13	24	4	481	76
11-15 (1391)	508	36	51	10	37	7	14	3	424	83
By Sex										
Boys (1390)	549	39	90	16	43	8	14	2	432	79
Girls (1474)	592	40	50	8	74	12	24	4	473	80
By location										
Urban (1449)	614	42	72	12	87	14	37	6	442	72
Rural (1415)	527	37	68	13	30	6	1	-	463	88

Figures in parentheses denote sample size

The prevalence of round worm which the schoolers could have actually seen, was 12%. This however, was much less than 20% recorded in the Focus Group Interviews (FGI 1994) and 24% observed by actual stool examination (Sentinel Study Report 1995).

Agewise (Table 5) more younger (6 to 10 years) than older schoolers (11 to 15 years) claimed to be intestinal parasite infected (43% vs 36%). Younger schoolers perhaps are less likely to practice personal hygiene norms which is considered to be one of the main causes of parasitic infections. Similar findings have been reported by Ramesh et al (1991). They examined stool samples for intestinal parasitic infections of 970 subjects whose age ranged between one year to above 50 years and reported that children between one to 10 years showed the highest rate of intestinal parasitic infections. In contrast, earlier Chhotray and Ranjit (1990) had observed helminthic infection to be significantly higher in 10 to less than 15 years versus 5 to less than 10 years old children (16% vs 10%).

Sexwise no differences were recorded in overall infection (Table 5) but more boys than girls had round worm infection (16% vs 8%). Hook worm infection on the other hand was higher among girls as compared to boys (8% vs 12%).

The prevalence of parasitic infection (Table 5) was higher among Urban versus Rural schoolers (42% vs 37%). This was not surprising because in this study, Urban schoolers were from Urban slums, where higher infection as compared to Rural schoolers has been reported by Bundy et al (1988) and Kan et al (1989).

(2) Intensity of intestinal parasitic infections in schooler

The intensity of infections in socio-economically and socio-culturally comparable schoolers was found to be of moderate to severe degree (Sentinel Study Report 1995). In the case of intestinal helminths (almost all Ascaris) 48% had **severe** (>25000 eggs/g feces) and 51% had **mild to moderate** degree of infections (<25000 eggs/g feces). In the case of protozoal infections (mainly E. histolytica) about 70% had **severe to moderate** degree of infections (>3 to 2 cysts/hpf).

Other studies have reported prevalence of a somewhat similar rate. Chhotray and Ranjit (1990) examined stool samples of 297 schoolers and found that 16% tested positive for only helminths, 34% for only protozoa and 15% for combined infections. The overall infection was 65%. Earlier Kanani (1984) had examined stool samples of 891 underprevileged primary school children in slum Baroda (Western India) and found that 15% suffered from helminthic and 25% protozoal infections amounting to overall infection of 40%. However, on questioning, 29% stated that they had a definite history of passing worms. The prevalence of intestinal parasitic infections has remained high in other parts of India also. It was 45% (A. lumbricoides) in Kerala (Krishnadas 1980), 66% in Himachal Pradesh (Tandon et al 1972) and 94% in Kashmir (Dhar et al 1979).

(3) Intestinal parasitic infections and environmental factors

Of the three variables studied, type of dwelling was significantly associated, while toilet and water facilities were not. However, a smaller proportion of infected versus not-infected schoolers lived in concrete houses (37% vs 63%) and had water facility at home (40% vs 60%). The rate of prevalence however did not vary whether the schoolers had toilet and water facilities at home or not (Table 6).

These findings corroborate those of Ramesh et al (1991) who have reported that the rate of prevalence of parasitic infections did not correlate with living conditions.

To summarize, 40% of the schoolers claimed to be infected with intestinal parasites. The infection was higher in younger than older age schoolers (43% Vs 36%) with no gender differences. More of Urban slum than Rural schoolers were infected (42% to 37%). The prevalence of intestinal parasitic infection did not associate with living conditions.

Table 6
Prevalence of intestinal parasitic infections among schoolers (6-15 years) by environmental factors in the Baseline covering the three study districts

Environmental factors	Infected		Not-infected	
	N	%	N	%
House construction :				
Concrete (1704)	629	37[a]	1075	63[b]
Non-Concrete (1160)	511	44[b]	649	56[a]
Availability of toilets at home :				
Yes (1363)	554	41	809	59
No (1501)	586	39	915	61
Pipe water facility at home :				
Yes (2287)	917	40[a]	1370	60[b]
No (577)	223	39	354	61

Figures in parentheses denote sample size
Figures having different superscript in the same row are significantly different from each other
Figures having different superscript in the same column between concrete and non-concrete house, are significantly different from each other

(4) Programme Implications

1. On questioning the schoolers, the prevalence for intestinal parasitic infections among the infected was stated to be 79% for thread worm. The overall helminthic infections were 40%. Even assuming that the prevalence of thread worm was overstated and confused with anal pruritis, *yet*, the overall prevalence of intestinal parasitic infections is so high as to be a *major public health problem.*

2. The WHO (1992) recommends *mass preventive deworming without screening* with albendazole, when the prevalence of intestinal helminths is >50%. In the Indian context, *mass preventive deworming* is certainly indicated for *all under-privileged schoolers in both the Urban and the Rural areas.*

3. These schoolers are multi-deprived-half of them do not have access to toilets (see Section One), most of them have a deplorable level of personal hygiene.

4. Since cheap and safe anthelmintics (albendazole and mebendazole) are now available, *all school-age children* should receive *bi-annual dosing, throughout their primary-school years atleast.* This will also aid in bringing down the overall prevalence of intestinal parasitic infections in the whole community.

SECTION THREE : THE OVERALL RECEIPT AND IMPACT OF THE SCHOOL HEALTH PACKAGE (ANTHELMINTICS + MICRONUTRIENTS) AND ITS IMPACT ON THE SCHOOLERS

Section Three deals with :

(1) The logistical delivery, receipt and impact of anthelmintic + micronutrient package on the schooler

(2) The receipt of the health inputs by Urban/Rural; by caste; by distance of the school from District Headquarter; and by age

(3) Schooler's awareness regarding the new school health package consisting of deworming, vitamin A and iron supplementation

(4) Programme implications.

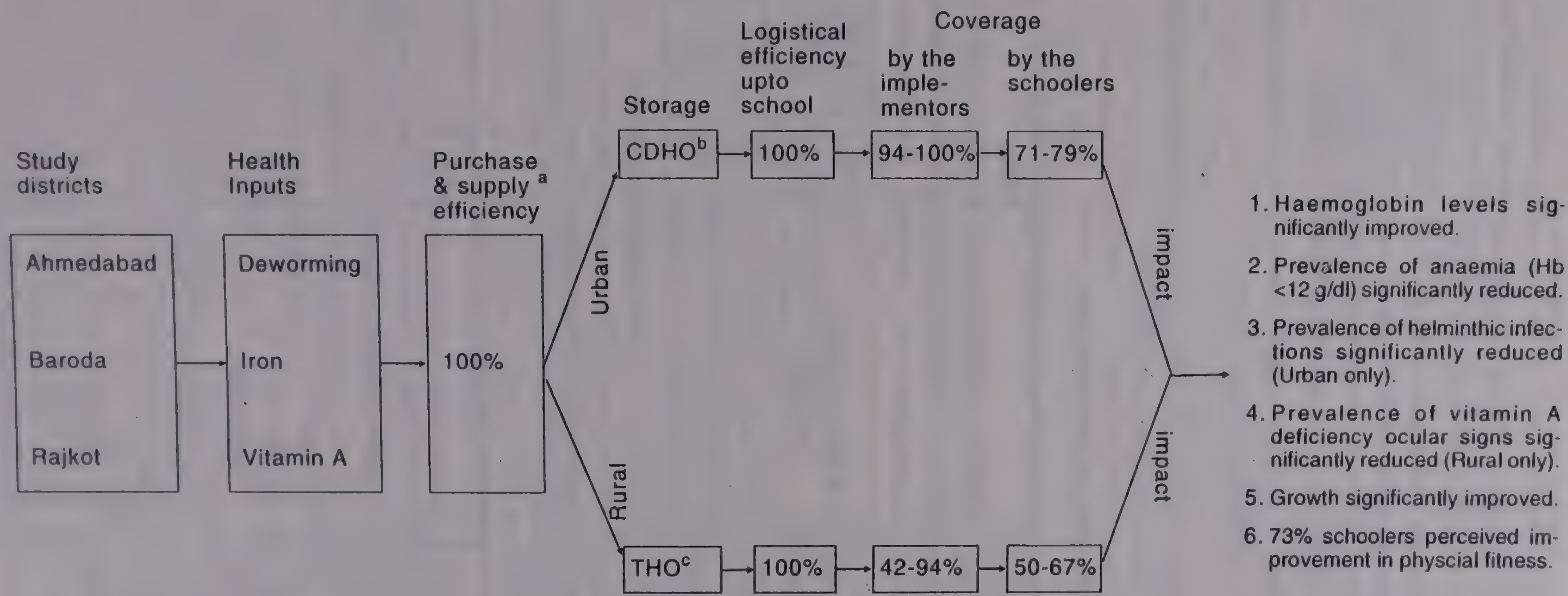
(1) The Logistical Delivery, Receipt and Impact of the Anthelmintic + Micronutrient Package on the Schooler

i) This is depicted in Figure 3. The flow diagram shows that the logistical delivery of the inputs **upto the schools** by the Implementors of the programme was 100%.

ii) There is a slight discrepancy in the coverage figures. The Implementors claimed that the coverage had been achieved in 94 to 100% of the Urban schools. The schoolers claimed that 71 to 79% of them had received the inputs.

Figure 3

An overview of the delivery logistics and impact of the health package on the schoolers (6-15 years) covering the three study districts.



[a] Local Pharma Company
[b] Chief District Health Officer
[c] Taluka Health Officer

iii) In the case of the Rural schools. 42% to 94% coverage was obtained. This was due to the unprecedented monsoons and the fear of the plague epidemic in 1994. Schoolers claimed receipt of 50% to 67% of the inputs in the dosing round or rounds.

iv) In the case of the Urban schools the outcome on health/nutritional impact was excellent. Prevalence of intestinal parasitic infections significantly reduced; haemoglobin levels and growth were significantly improved; and the physical fitness (perceived) of 73% of the schoolers improved (please see Sections Four to Seven for details).

v) The picture with respect to the Rural schooler was the same except for the ocular signs of vitamin A deficiency, which significantly reduced.

(2) The receipt of the health inputs by Urban/Rural; by caste; by distance of the school from District Headquarters; and by age

Coverage of schoolers for the health inputs :

Schoolers were asked whether they had received the tablets. Sixty percent of the schoolers stated in the affirmative for deworming, 64% for vitamin A supplementation and 73% for iron supplementation (Table 7). **The coverage was significantly higher for all the three inputs (albendazole tablets, vitamin A capsule and iron tablets) among the Urban than the Rural schoolers.** A similar trend was observed when the data were analysed for only one district namely, Baroda (Process Evaluation Report, 1995).

Table 7
Precent schoolers (6-15 years) who received health inputs from their schools in the past one year in the Resurvey covering the three study districts

Health inputs received	Urban (1535)		Rural (1429)		Total (2964)	
	N	%	N	%	N	%
Albendazole tablets	1085	71[a]	708	50[b]	1793	60
Vitamin A capsules	1136	74[a]	767	54[b]	1903	64
Iron tablets	1216	79[a]	959	67[b]	2175	73

Figures in parentheses denote sample size
Figures having different superscript in the same row are significantly different from each other

Castewise no differences were observed in the coverage of schoolers for health inputs (Table 8). Likewise, distance between a village and its respective Taluka HQ made no difference in the implementation of the health inputs programme. A comparable proportion of schoolers received health inputs whether their school was at less than or more than 50 km distance from the Taluka HQ (Table 9).

Table 8
Health inputs received by the schoolers (6-15 years) with respect to their castes in the Resurvey covering the three study districts

Health inputs received	BC/SC/ST (2551)		Others (413)		Total (2964)	
	N	%	N	%	N	%
Albendazole tablets	1557	61	236	57	1793	60
Vitamin A capsules	1646	65	257	62	1903	64
Iron tablets	1878	74	297	72	2175	73

Caste : Caste categorization - see footnote on Table 2
Figures in parentheses denote sample size

Age of schoolers appeared to have affected the coverage. Significantly a larger proportion of younger (6-10 years) than the older (11-15 years) age schoolers claimed to have received each of the health inputs (Table 10). A similar trend was reported by Kanani (1984) and Bakshi (1989). This indicates that special attention needs to be given to Information Education Communication (IEC) component for the older schooler.

However, there was a disparity between the proportion of schoolers who received the health inputs as stated by the implementors and by the schoolers themselves. As per the implementors, 94% to 100% schoolers in the Urban and 42% to 94% schoolers in the Rural sectors were covered (Process Evaluation Report, 1995) but less than 80% schoolers in Urban and less than 60% schoolers (except for iron tablets) in the Rural sectors claimed to have received the health inputs (Table 11). We are unable to determine where to lay the blame as we found that a majority of schoolers whom we (TCS) had dosed in one Urban School of Baroda, did remember that they had been dosed.

Table 9

Health inputs received by the Rural schoolers (6-15 years) with respect to distance of the taluka from the respective district headquarters in the Resurvey covering the three study districts

Health inputs received	< 50 km (525)		> 50 km (904)		Total (1429)	
	N	%	N	%	N	%
Albendazole tablets	269	51	439	49	708	50
Vitamin A capsules	301	57	466	52	767	54
Iron tablets	343	65	616	68	959	67

Figures in parentheses denote sample size

Table 10

Health inputs received by the schoolers (6-15 years) with respect to their age in the Resurvey covering the three study districts

Health inputs received	6-10 Years (1561)		11-15 Years (1403)		Total (2964)	
	N	%	N	%	N	%
Albendazole tablets	1087	70[a]	706	50[b]	1793	60
Vitamin A capsules	1117	72[a]	786	56[b]	1903	64
Iron tablets	1285	82[a]	890	65[b]	27175	73

Figures in parentheses denote sample size
Figures having different superscript in the same row are significantly different from each other

Table 11

Health inputs received by the schoolers (6-15 years) as stated by the implementors and the schoolers themselves in the Resurvey covering the three study districts

Health inputs received	By implementors		By schoolers		Total %
	Urban %	Rural %	Urban %	Rural %	
Albendazole tablets	94 - 100	42 - 94	71	50	60
Vitamin A capsules	94 - 100	42 - 94	74	54	64
Iron tablets	94 - 100	42 - 94	79	67	73

(3) Schooler's awareness regarding the new School Health Package consisting of deworming, vitamin A and iron supplementation

Towards the end of our Baseline Survey the schoolers were informed mainly by their teachers about the new 'Health Inputs Programme'. They were told in simple terms that these health inputs consisted of :

- One chewable and sweet-tasting albendazole tablet which would be given 2 times. Once at the beginning of each school term i.e. 2 terms/school year.
- One capsule of vitamin A which would be given 3 days after the albendazole tablet at the beginning of each school term.
- One tablet of iron which would be given for 85 days per school term along with the Mid-Day-Meal.
- This programme rode piggy-back on the existing MDMP. In addition, a documentary-type of film was produced by the GOG with the help of TCS. The film was telecast several times before the launch of the 'School Health' programme.

The MDMP Commissionerate and the Health Education Department of the GOG brought out a leaflet called "*Marg-darshak*" in the regional language. The leaflet carried simple information regarding the dosing schedules and the benefits of the health inputs. The principals of all the schools concerned with the MDMP were provided with these leaflets and were instructed to read it carefully and pass on the information to their teachers and students.

However Table 12 shows that only one-third of the schoolers in the Baseline survey and a little over 40% in the Resurvey were aware of the benefits of the health inputs. **Lack of enforcement of the "Marg" information by the Organizers and Teachers seems to have contributed to this.**

Table 12

Schooler's (6-15 years) awareness regarding deworming, vitamin A and iron supplementation in the Baseline and Resurvey covering the three study districts

Variables	Baseline						Resurvey					
	Urban		Rural		Total		Urban		Rural		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Have you been informed about these tablets ?												
Yes	337	23^a	566	40^b	903	31^a	706	46^b	528	37^c	1234	42^b
No	1118	77	851	60	1969	69	829	54	901	63	1730	58
Total	1455	100	1417	100	2872	100	1535	100	1429	100	2964	100
Awareness Sources												
T.V.	67	20			67	20	68	20	68	20	101	30
Teacher	129	38	425	75	554	61	533	75	399	76	932	76
Organiser	19	6	101	18	120	13	7	1	81	15	88	7
Parents	73	22	13	2	86	10	46	7	14	3	60	5
Any Other	119	35	22	4	141	16	121	17	33	6	154	12
Total	337	100	566	100	903	100	706	100	528	100	1234	100

Any other = Research staff of the Tara Consultancy Services

Figures under each matching head having different superscript in the same row between surveys are significantly different from each other

To explore Knowledge, Attitude and Practices, schoolers were asked what they would do if they suffer from intestinal parasitic infections, vitamin A and iron deficiencies. The universal response was "go to a doctor" (Table 13).

On inquiry at the Baseline survey, whether the schoolers would willingly swallow the tablets if provided to them in order to deworm them and cure/prevent their vitamin A and iron deficiencies, almost all said they would (Table 14). In our Focus Group Interviews (FGI 1994) also, parents of school children had stated that if the school distributed *"golis"* (tablets) to their children they would see that their children followed the prescribed tablet schedule.

What was rather surprising was that 33% to 65% of the schoolers appeared to have adequate knowledge about albendazole tablets, vitamin A capsules and iron tablets even at the Baseline survey. The film on the 'Health Inputs' which was televised several times on the local TV Channel - may have contributed to this pre-knowledge level.

Table 13

Knowledge, Attitude and Practices about intestinal parasitic infections and micronutrient deficiencies of schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts

Action if child suffers from the following	Baseline		Resurvey	
	N	%	N	%
Intestinal parasitic infection				
Do nothing	135	5	125	4
Go to doctor/vaid	2565	89	2556	86
Go to chemist	355	12	420	14
Go to school teacher	47	2	27	1
Any other	21	1	23	1
Total	2872	100	2964	100
Vitamin A deficiency				
Do nothing	127	4	95	3
Go to doctor/vaid	2587	90	2607	88
Go to chemist	322	11	382	13
Go to school teacher	57	2	28	1
Any other	22	1	33	1
Total	2872	100	2964	100
Iron deficiency anaemia				
Do nothing	104	4	79	3
Go to doctor/vaid	2576	90	2534	85
Go to chemist	323	11	427	14
Go to school teacher	44	2	27	1
Any other	108	4	92	3
Total	2872	100	2964	100

Any other : For Parasitic infection :- Take home medicine; Go to "Tantrik"
For Vitamin A :- Eat more greens; Go to "Tantrik"
For Iron deficiency :- Blood Transfusion

Table 14

Schooler's (6-15 years) acceptance of deworming, vitamin A and iron supplementation in the Baseline and Resurvey covering the three study districts

Acceptance	Baseline						Resurvey					
	Urban		Rural		Total		Urban		Rural		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Yes	1370	94^a	1353	95^a	2723	95^a	1490	97^a	1354	95^a	2844	96^a
No	85	6^b	64	5^b	149	5^b	45	3^b	75	5^b	120	4^b
Total	1455	100	1417	100	2872	100	1535	100	1429	100	2964	100

Figures having different superscript in the same column are significantly different from each other

Despite all these efforts to educate schoolers regarding the health inputs, only 41% in the Resurvey responded to the question regarding benefits of the health inputs (Table 15). Of the 41% who did respond, it was heartening to note that 55 to 82% schoolers exhibited appropriate knowledge. For deworming, the schoolers stated that it removes worms and makes them grow stronger and bigger and keeps away stomach problems. For vitamin A supplementation they said it makes them see better, reduces frequency of illness, improves health and gives strength. For iron supplementation the schoolers said it makes them play/work well, makes them more attentive in class; gives them strength and increases their appetite (Table 15).

Table 15

Schooler's (6-15 years) knowledge regarding the benefits of deworming, vitamin A and iron supplementation in the Baseline and Resurvey covering the three study districts

Knowledge	Baseline						Resurvey					
	Boys		Girls		Total		Boys		Girls		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Have knowledge	377	27[a]	443	30[a]	820	29[a]	558	38[b]	672	45[b]	1230	41[b]
Do not have knowledge	1018	73[b]	1034	70[b]	2052	71[b]	910	62[c]	824	55[c]	1734	59[c]
Total	1395	100	1477	100	2872	100	1468	100	1496	100	2964	100
REGARDING :												
Deworming												
Remove all worms	173	46	220	50	393	48	276	49	404	60	680	55
Makes me grow stronger/bigger	67	18	62	14	129	16	21	4	11	2	32	3
Any other							2	0	6	1	8	1
Vitamin A supplementation												
Makes me see better	103	27	165	37	268	33	314	56	426	63	740	60
Reduces frequency of illness	122	32	131	30	253	31	38	7	30	4	68	6
Any other							9	2	5	1	14	1
Iron supplementation												
Makes me play/ work better	243	64	293	66	536	65	452	81	562	84	1014	82
Makes me more attentive in class	40	11	66	15	106	13	29	5	34	5	63	5
Any other							59	11	70	10	129	10

Any other : For deworming :- Cures diarrhoea, fever, stomach ache
For vitamin A supplementation :- Improves health, gives strength
For iron supplementation :- Gives strength, helps to grow tall, increase appetite

Figures under each matching head having different superscript in the same row between the surveys are significantly different from each other

Figures having different superscript in the same column are significantly different from each other

On the whole the knowledge of schoolers regarding the benefits of deworming was poorer than for vitamin A and iron supplementation.

Our impact findings on KAP among the schoolers clearly indicates that the "Information-Education-Communication" component needs to be greatly strengthened among the Teachers, Schoolers and Parents. TV may be the most powerful medium to do this.

(4) Programme Implications

1. **The integration of the school health inputs of an anthelmintic and micronutrients cost the Gujarat MDMP only Rs.10.56 (US 35 Cents) per schooler per annum. Even calculated at Rs.15/schooler/year into 5 to 7 school years of primary school, this would cost only Rs.75 to Rs.105 for an extremely sustainable, cost-effective and impactful programme.**

2. **Since the majority of the schoolers in the Government free schools come from the poorest socio-economic segments, it is all the more necessary to integrate the anthelmintic + micronutrient package into the centrally financed Mid-Day-Meal Scheme. Approximately 40 million schoolers are now covered by the National MDMP. About 160 million will be covered by 1997-'98.**

3. **Approximately Rs.2400 million/annum is a small price to pay to dramatically reduce the high levels of intestinal parasitic infections and the major micronutrient deficiencies that the schoolage population suffers from. Intestinal parasite control would greatly enhance growth, iron and vitamin A status. There is a definite synergism between adequacy in the above micronutrients and *improved learning capacity*. The nutritional and health impact of the Mid-Day-Meal can be enhanced manifold times by the catalytic addition of the above inputs. In fact we should ask ourselves the question of whether we can afford to deny our schoolers this intervention?**

4. **The multiplier effect of a satisfied schooler being the best IEC agent for his/her family is immense and should be exploited. The school can become a Strong Second Line of Health Defence for the whole community and our nation.**

SECTION FOUR : IMPACT OF THE SCHOOL HEALTH PACKAGE ON IRON DEFICIENCY ANAEMIA (IDA) IN THE SCHOOLERS

Section Four includes :

(1) Impact of health inputs on haemoglobin levels of iron-deficient (Hb <12 g/dl) and non iron-deficient schooler

(2) Impact of health inputs on the morbidity status of iron-deficient and non iron-deficient schooler

(3) Impact of health inputs on the prevalence of vitamin A deficiency ocular signs in iron-deficient and non iron-deficient schooler

(4) Impact of health inputs on physical growth of iron-deficient and non iron-deficient schooler

(5) Programme implications.

This section is devoted to the impact of the "anthelmintic + micronutrient package" specifically on the haemoglobin or iron status of the schooler. The beneficial **functional relationship** between an adequate or near adequate iron status (Hb>12 g/dl) has been amply proven (Pollitt et al 1989; Gopaldas et al 1985; Soemantri 1989; Aggarwal 1991; Kashyap and Gopaldas 1987b; Seshadri and Gopaldas 1989). The most important benefit being, that improving a schooler's iron status would be improving his performance in certain areas of Cognition such as Concentration, Immediate Memory and Attention. This would make him/her a more **Actively Learning Child**. Another major benefit would be to vastly improve his/her **Physical Work Capacity**. The ground realities are that these schoolers will have to cope with physical labour (please see Section One) throughout their school years and beyond. Therefore, any feasible strategy that would help to **improve and sustain their haemoglobin levels**, would directly benefit them to perform better in the class-room, in the playing field and in their physical and domestic labour.

(1) Impact of health inputs on haemoglobin levels of iron-deficient (Hb<12 g/dl) and non iron-deficient schoolers :

Haemoglobin estimations were done to detect the prevalence of IDA before and six to nine months after the implementation of the health inputs which included 60 mg of elemental iron per day for 85 days/school term.

At the Baseline survey the mean haemoglobin level of the younger (6-10 years) and the older (11-15 years) age boys as well as girls ranged between 10.5±0.06 and 10.9±0.06 g/dl (Table 16). Earlier Kanani and Gopaldas (1988) had reported almost similar levels of haemoglobin in a socio-economically similar group of 5 to 15 years of age boys (10.2±0.07 g/dl) and girls (10.5±0.07 g/dl).

At the Resurvey (Table 16) there was an average increase of 1.2 g Hb/dl in both the age group of schoolers in both the sexes (11.8±0.04 vs 10.6±0.04 g/dl). In the younger age schoolers the haemoglobin levels increased from 10.5±0.06 g/dl to 11.7±0.05 g/dl in the boys and from 10.5±0.05 g/dl to 11.6±0.05 g/dl in the girls. The corresponding values for older schoolers were 10.9±0.06 g/dl to 12.0±0.06 g/dl and 10.5±0.07 g/dl to 11.9±0.06 g/dl.

Table 16
Impact of health inputs on the mean haemoglobin levels (g/dl) of schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts

Age groups	Baseline	Resurvey
	Mean ± SEM	
6-10 years		
Boys	10.5 ± 0.06^{a} (650)	11.7 ± 0.05^{b} (818)
Girls	10.5 ± 0.05^{a} (644)	11.6 ± 0.05^{b} (852)
11-15 years		
Boys	10.9 ± 0.06^{a} (581)	12.0 ± 0.06^{b} (623)
Girls	10.5 ± 0.07^{a} (601)	11.9 ± 0.06^{b} (626)
6-15 years		
Boys	10.7 ± 0.04^{a} (1231)	11.9 ± 0.04^{b} (1441)
Girls	10.5 ± 0.04^{a} (1245)	11.7 ± 0.04^{b} (1478)

Figures in parentheses denote sample size
Figures having different superscript in the same row, between surveys are significantly different from each other

This increase was attributed mainly to the iron supplementation that the schoolers received six to nine months prior to the Resurvey. These findings

suggested that the low haemoglobin levels (less than the WHO cutoff point of <12 g/dl) were mainly due to iron deficiency. More so because a mean haemoglobin response of >1.0 g/dl to oral iron therapy has been considered a diagnostic test for IDA (Dallman et al 1992).

In 1983, Kanani and Gopaldas had supplemented 5 to 13 year old under-privileged children with a package of 20 mg elemental iron and 0.1 mg folic acid daily for 60 days, a dose of 200,000 IU of vitamin A and anthelmintic and antiprotozoal tablets. The investigators observed a significant increase in mean haemoglobin level of 1.9 g/dl in 5 to 9 years and 1.0 g/dl in 10 to 13 years old children. Increases in haemoglobin levels by 1.17 g/dl and 1.25 g/dl in response to 30 mg and 40 mg iron respectively, given daily for 60 days, have been reported by Gopaldas and Kale (1985). Relatively higher increases in haemoglobin levels from 9.8 to 13.3 g/dl in anaemic children (8 to 13 years) in response to 2 mg elemental iron per kg body weight per day for 12 weeks have also been reported (Chwang et al 1988).

The iron deficiency in the present study schoolers could be due to inadequate iron intake and increase in iron loss as a result of intestinal parasitic infections (Pawloski et al 1991). Many studies in India have reported inadequacy of iron intake of underprivileged school children (Kanani and Gopaldas 1983, 1988; Gopaldas et al 1983a). Not only inadequate iron intake but poor bioavailability of iron is believed to determine iron status of an individual (INACG 1989). In the present evaluation the iron intake of a similar group of schoolers was below 40% RDA (Sentinel Study Report 1995) and its source was mainly cereals which is known to be of poor bioavailability. More recent studies have implicated vitamin A deficiency leading to iron deficiency and have suggested that supplementation of iron with vitamin A is necessary to combat nutritional anaemia (Suharno et al 1993). In the present study 10% schoolers were seen to be xerophthalmic exhibiting night-blindness and/or Bitot's spot (to be discussed later). Hence deficiency of vitamin A could to some extent, have contributed to the prevalence of IDA. Fortunately the health inputs received by the schoolers included a six monthly dose of 200,000 IU vitamin A.

Impact of health inputs on prevalence of IDA among schoolers

The prevalence of IDA is considered to serve as an index of the severity of iron deficiency and iron deficiency contributes significantly to the high prevalence of IDA (Yip 1994).

At the Baseline survey 84% (Table 17) schoolers were found to be iron deficient anaemic (Hb <12 g/dl). Sexwise no differences were observed in the prevalence of IDA but locationwise significantly more of Rural than Urban schoolers were found to suffer from IDA (92% vs 78%). Similar findings have been reported by Shingla et al (1980). Based on an increase in packed cell volume in response to hematinic tablets containing 82.5 mg elemental iron, 3 mg folic acid, 5 mcg of cyanocobalamin and 50 mg of ascorbic acid, the authors reported that prevalence of anaemia was significantly higher in Rural than Urban children (34% vs 69%).

At the Resurvey there was a significant reduction in the prevalence of IDA (84% to 53%). The significant reduction was seen in Urban (57%) as well as Rural schoolers (92% to 49%) using the WHO cut-off of a Hb concentration of <12 g/dl (WHO 1968).

Table 17

Impact of health inputs on the prevalence of IDA among schoolers (6-15 yrs) in the Baseline and Resurvey covering the three study districts

	Baseline						Resurvey					
	Boys		Girls		Total		Boys		Girls		Total	
	N	%	N	%	N	%	N	%	N	%	N	%
Urban												
Iron-deficient	530	77^{a}	573	79^{a}	1103	78^{a}	408	56^{b}	441	57^{b}	849	57^{b}
Non Iron-deficient	115	23	151	21	306	22	319	44	331	43	650	43
Rural												
Iron-deficient	492	90^{ab}	491	94^{ab}	983	92^{ab}	317	44^{bc}	378	54^{b}	695	49^{bc}
Non Iron-deficient	54	10	30	6	84	8	397	56	328	46	725	51
Total												
Iron-deficient	1022	83^{a}	1064	86^{a}	2086	84^{a}	725	50^{b}	819	55^{b}	1544	53^{b}
Non Iron-deficient	209	17	181	14	390	16	716	50	659	45	1375	47

IDA = < 12 g Hb/dl
Figures under each matching head having different superscript in the same row between surveys are significantly different from each other
Figures having different superscript in the same column between urban and rural are significantly different from each other

The distribution curve of haemoglobin levels show a clear shift to the right of the cut off point of <12 g Hb/dl in response to the health inputs (Figure 4). At the Baseline Survey, 84% schoolers were on the left hand side of the cut off point. Of these 56% were in the region of 10 to 11 g Hb/dl and the remaining 28% were towards the extreme left of the cut off point corresponding to haemoglobin levels of below 10 g/dl.

The shift to the right increased the proportion of schoolers in the region of above 12 g Hb/dl from 17% at the Baseline survey to 47% at the Resurvey. There were only 9% schoolers at the Resurvey as against 28% at the Baseline survey in the region of less than 10 g/dl. Similar shift towards right of the curve was observed by Kanani (1984) in response to 20 mg elemental iron given daily for 60 days to 5 to 15 years old children.

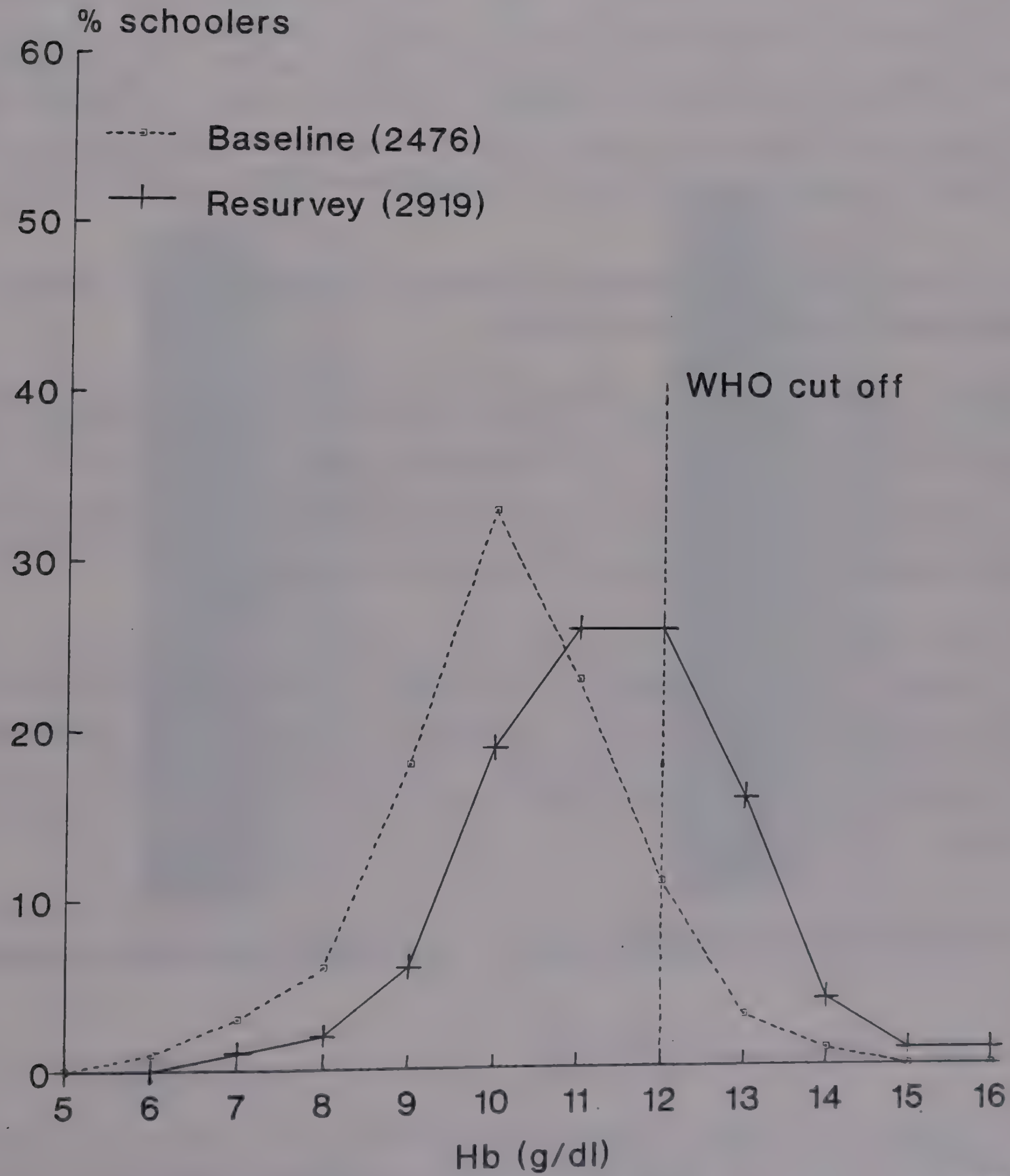
(2) Impact of health inputs on morbidity status of iron-deficient and non iron-deficient schooler

Records were maintained on the morbidity status of schoolers because of the well recognized association of morbidity with nutrition especially with respect to diarrhoeal diseases, growth, and its role in excerbating the negative effects of inadequate nutrient intake (Allen et al 1992).

The schoolers were asked whether they had suffered during the past two months from severe diarrhoea (more than 3 stools in a day lasting for more than 3 days) and/or severe dysentery (passing of mucous and/or blood in stool and colic pain); upper respiratory tract infection (cough, cold with or without fever); acute respiratory tract infection (pneumonia); and

Figure 4

Frequency distribution of haemoglobin levels (g/dl) in schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts



Figures in parentheses denote sample size

fevers (typhoid, malaria). A schooler was considered to be morbid when he/she had suffered from at least one kind of the morbidities listed above during the specified period of time.

No appreciable differences were observed in morbidity status of iron-deficient and non-iron-deficient schoolers at the Baseline survey as well as at the Resurvey (Figure 5). As a matter of fact a larger proportion of non iron-deficient schoolers tended to be morbid at the Baseline survey (55% vs 51%) and at the Resurvey (52% vs 49%).

Contradictory results have been reported with respect to prevalence of morbidity in iron-deficient versus non iron-deficient school children/pregnant women. In support of our findings Allen et al (1992) reported no difference in illnesses between iron-deficient and non-iron-deficient schoolers. In contrast Fleming (1989) had seen higher morbidity in iron-deficient versus non iron-deficient pregnant women. This was attributed to the association that exists between iron and cell mediated/non specific immunity (Dallman 1987, Chandra and Puri 1985). Earlier Bagchi et al (1980) had reported that the production of T cells is specifically compromised in iron deficiency. However regardless of the iron status, the proportion of schoolers who were morbid tended to be slightly smaller at the Resurvey than at the Baseline survey in both iron-deficient (49% vs 51%) and non iron-deficient (52% vs 55%) schoolers.

(3) Impact of health inputs on prevalence of vitamin A deficiency ocular signs in iron-deficient and non iron-deficient schooler

Iron deficiency anaemia and hypo-vitaminosis A are considered to be the two major nutritional problems among schoolers. Since schoolers with even mild xerophthalmia (night blindness or Bitot's spot) are at a greater risk of developing anaemia (Mohanram et al 1977, Mejia et al 1977), we considered it worthwhile to examine xerophthalmic status of iron-deficient and non iron-deficient schoolers. A schooler having any one specific sign of vitamin A deficiency ocular sign (night-blindness or Bitot's spot) was considered xerophthalmic.

Figure 6 shows that a significantly larger proportion of iron-deficient versus non iron-deficient schoolers were xerophthalmics at the Baseline survey (9.6% vs 5.8%) and non-significantly at the Resurvey (4.8% vs 4.1%). In response to the health inputs, the prevalence of xerophthalmia decreased in both iron-deficient anaemics (9.6% vs 4.8%) and non iron-deficient anaemics (5.8% vs 4.1%). This could mainly be due to the vitamin A component of the health inputs.

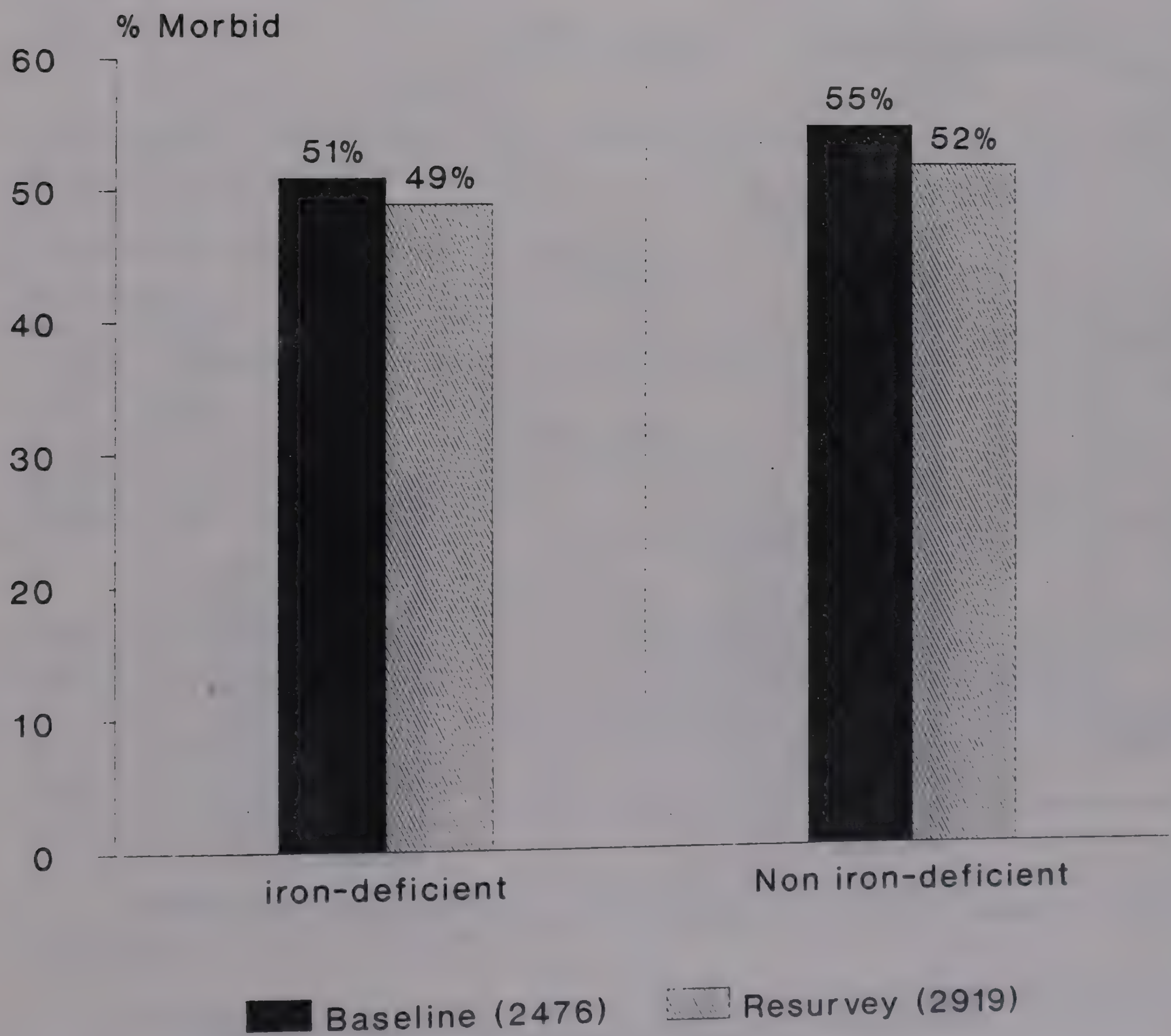
(4) Impact of health inputs on physical growth of iron-deficient and non iron-deficient schoolers

Weight-for-age

Table 18 shows that the younger (6-10 years) as well as the older (11-15 years) age iron-deficient schoolers were significantly lighter and shorter than their non iron-deficient counterparts in both the surveys. These findings are supported by those of Chwang et al (1988) who had found that children with iron deficiency anaemia (0.98 g Hb/L) weighed less and were shorter than those classified as normal (1.32 g Hb/L). It has been hypothesised that growth retardation in iron deficient children might be due to the

Figure 5

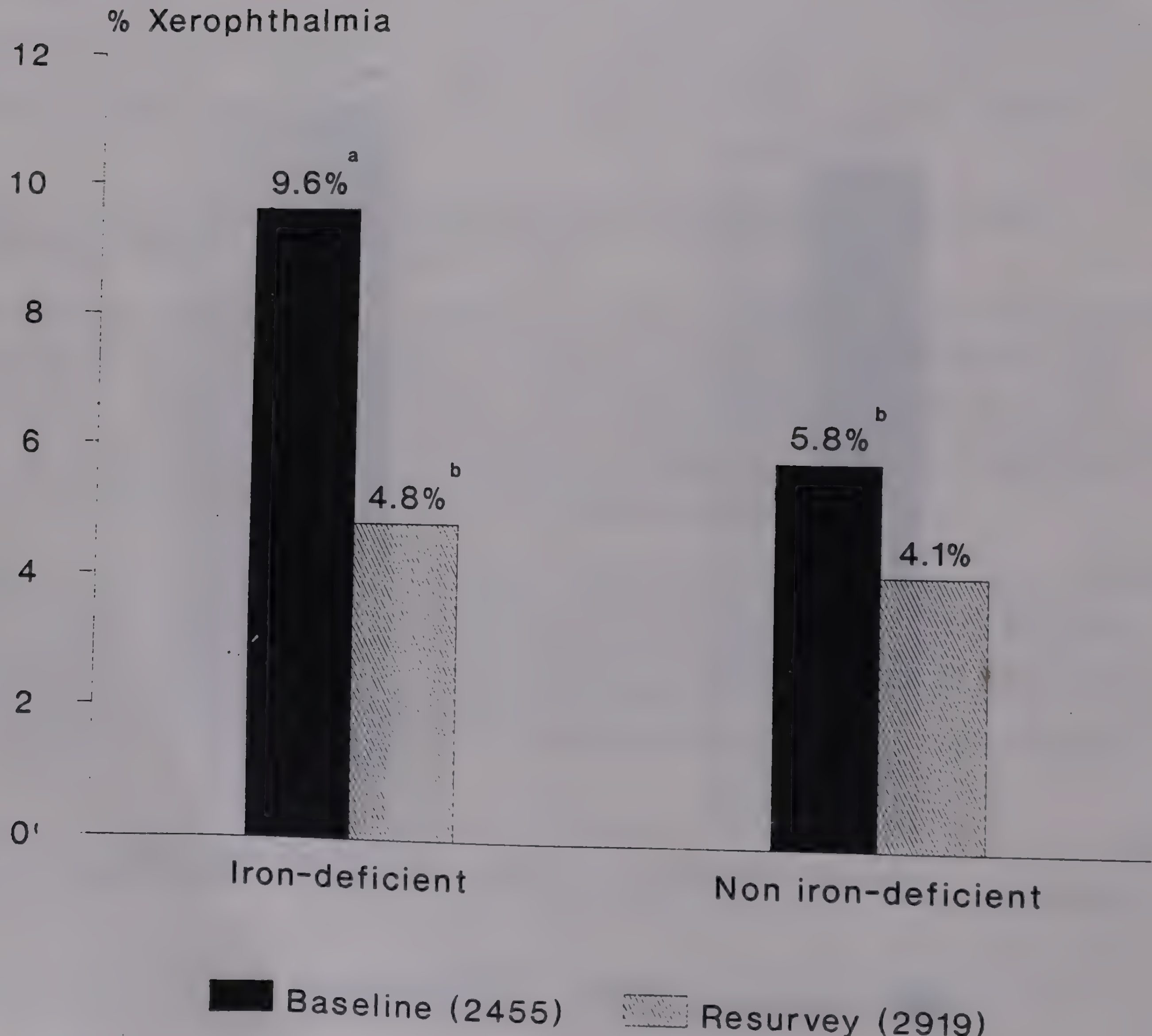
Morbidity status of iron-deficient and non iron-deficient schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts



Figures in parentheses denote sample size

Figure 6

Prevalence of xerophthalmia (excluding X1A) in iron-deficient and non iron-deficient schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts



Figures in parentheses denote sample size

Figures having different superscript between and within surveys are significantly different from each other

role of iron as an essential metabolic co-factor (Dallman 1987), iron's relation to immunocompetence (Chandra and Puri 1985) and its role in appetite depression (Basta et al 1979).

In response to health inputs, significant increases were observed in the weight of older schoolers and in the height of younger schoolers between iron-deficient and non iron-deficient anaemics (Table 19).

The increases in weight and height from Baseline survey to Resurvey were calculated for the iron-deficient and non iron-deficient schoolers whose anthropometric measurements were available in both the surveys (matched schoolers). The weight and height increments in relation to age group, sex and location are pre sented in Table 19.

Age-wise, older (11-15 years) non iron-deficient schoolers were significantly heavier than their iron-deficient counterparts, while height significantly differed in favour of non iron-deficients in only younger age (6-10 years) schoolers.

Table 18

Impact of health inputs on the mean weight (kg) and height (cm) of iron-deficient and non iron-deficient schoolers (6-15 years) by age in the Baseline and Resurvey covering the three study districts

Age groups	Baseline	Resurvey
Weight (Mean ± SEM)		
6-10 years		
Iron-deficient	18.6 ± 0.10^{a} (117)	19.0 ± 0.12^{b} (971)
Non iron-deficient	19.4 ± 0.24^{ab} (176)	20.1 ± 0.14^{bc} (698)
11-15 years		
Iron-deficient	27.0 ± 0.17^{a} (968)	28.2 ± 0.22^{b} (572)
Non iron-deficient	27.8 ± 0.36^{ab} (214)	29.2 ± 0.22^{bc} (675)
Height (Mean ± SEM)		
6-10 years		
Iron-deficient	117.3 ± 0.277^{a} (1117)	117.2 ± 0.29^{a} (970)
Non iron-deficient	119.7 ± 0.65^{b} (176)	120.6 ± 0.34^{b} (698)
11-15 years		
Iron-deficient	136.7 ± 0.30^{a} (968)	138.2 ± 0.36^{b} (572)
Non iron-deficient	139.3 ± 0.63^{ab} (214)	140.8 ± 0.35^{bc} (675)

Figures in parentheses denote sample size
Figures having different superscript in the same row between surveys are significantly different from each other
Figures for each age group having different superscript in the same column between iron-deficient and non iron-deficient are significantly different from each other

Sex-wise, besides iron-deficient anaemics being shorter and lighter than the non iron-deficient anaemics, girls tended to be heavier than the boys perhaps due to an early growth spurt (Tanner 1970).

Locationwise, similar trends between iron-deficient anaemics and non iron-deficient anaemics were recorded but the Urban schoolers tended to be heavier and taller than their Rural counterparts.

Similar findings have been reported by Chwang et al (1988). The authors observed significant increases in weight and height of anaemic children in response to iron treatment (2 mg elemental iron/kg b.wt./day for 12 weeks). In contrast to our findings the authors however

had recorded no improvement in growth in normal children following iron treatment. This might be due to the differences in higher initial haemoglobin levels of our non iron-deficient and Chwang et al's normal children. We had classified any schooler having haemoglobin level equal to or above 12 g/dl as non iron-deficient while in Chwang's study the mean haemoglobin level of normal children was 1.33 g/L. Increases in weight gain and psychomotor development following iron treatment to children has been reported by Aukett et al (1986).

Earlier Lawless et al (1991) evaluated the effects of iron supplementation on the physical growth of Kenyan children and had shown a significant increase in body weight following iron supplementation. The Kenyan children had also experienced improvement in appetite (Latham et al 1991).

In a nutshell, from the Baseline survey to Resurvey (a) mean haemoglobin levels of schoolers significantly improved by 1.0 to 1.4 g/dl (10.7±0.04 to 11.9±0.04 g/dl in boys and 10.5±0.04to 11.7±0.04 g/dl in girls), (b) prevalence of iron- deficiency (Hb <12 g/dl) significantly decreased from 84%to 53%, (c) a smaller proportion of iron-deficient anaemics versus non iron-deficient anaemics exhibited xerophthalmia (night-blindness 4.8%vs 9.6%, Bitot's spot 4.1% vs 5.8%) and (d) growth of the schoolers significantly improved as a result of the implementation of the health inputs programme.

Table 19

Impact of health inputs on the mean gain in weight and height of iron-deficient/non iron-deficient matched schoolers (6-15 years) in relation to age group, sex and location covering the three study districts.

Variables	Weight (kg)	Height (cm)
Age group	Mean ± SEM	
6 - 10 years		
Iron-deficient	1.4 ± 0.04 (582)	2.7 ± 0.04a (581)
Non Iron-deficient	1.4 ± 0.04 (445)	2.9 ± 0.05b (445)
11-15 years		
Iron-deficient	2.0 ± 0.07a (349)	2.7 ± 0.06 (349)
Non Iron-deficient	2.3 ± 0.07b (458)	2.8 ± 0.06 (458)
Sex		
Boys		
Iron-deficient	1.5 ± 0.05a (428)	2.7 ± 0.05a (428)
Non Iron-deficient	1.7 ± 0.05b (478)	2.8 ± 0.06b (478)
Girls		
Iron-deficient	1.7 ± 0.05a (503)	2.7 ± 0.05 (502)
Non Iron-deficient	2.1 ± 0.07b (425)	2.8 ± 0.05 (425)
Location		
Urban		
Iron-deficient	1.8 ± 0.05a (469)	2.9 ± 0.05 (468)
Non Iron-deficient	2.0 ± 0.07b (454)	2.9 ± 0.05 (454)
Rural		
Iron-deficient	1.4 ± 0.05a (462)	2.5 ± 0.05a (462)
Non Iron-deficient	1.7 ± 0.05b (449)	2.7 ± 0.06b (449)

Figures in parentheses denote sample size
Figures having different superscript in the same column between iron-deficient and non iron-deficient are significantly different from each other

(5) Programme implications

1. It is of utmost importance to cover *all* schoolers for *preventive IDA*. This is crucial to having *Actively Learning Children* (Cognition and Physical Work Capacity) in our classrooms. The National IDA Control programme *has by-passed and still by-passes this extremely vulnerable and easily accessible target population*. For maximum elevation and sustainability of adequate haemoglobin levels, it is imperative to give *anthelmintic + micronutrients*.

2. The Improved Mid-Day-Meal Programme of Gujarat has amply shown how feasible and cost-effective it is to integrate the "School Health Package" into the on-going MDMP.

3. It is urged that the Government of India follow the "Gujarat Model" in its Centrally sponsored MDMP Scheme (August 15, 1995-continuing). For a start, atleast the States and UTs that have opted for a cooked Mid-Day-Meal can do so.

4. Even those States/UTs *not* opting for a cooked meal, but for grain distribution, can easily deliver *double-fortified salt (iron and iodine)* through the Public Distribution System. Bi-annual campaigns for deworming and vitamin A capsule distribution can and should be done *regardless* of a State/UT opting for a cooked MDM.

5. In short, the schooler, especially the pre-adolescent/adolescent desperately requires *his/her* haemoglobin status to be improved. Whether this be by supplementation, fortification or dietary means or combinations thereof, the important thing is to get the *Iron* into the schooler. These schoolers are going to be the parents and citizens of tomorrow.

6. A satisfied schooler can be the best communicator to his/her family.

SECTION FIVE : IMPACT OF THE SCHOOL HEALTH PACKAGE ON THE INTESTINAL PARASITIC STATUS OF THE SCHOOLERS

Section five includes :

(1) Impact of the health inputs on the intestinal parasitic status of the schooler

(2) Impact of the health inputs on the haemoglobin status of the schooler in relation to intestinal parasitic infections

(3) Impact of the health inputs on the morbidity profile of the schooler in relation to intestinal parasitic infections

(4) Impact of the health inputs on the prevalence of xerophthalmia in the schooler in relation to intestinal parasitic infections

(5) Impact of the health inputs on nutritional anthropometry of the schooler in relation to intestinal parasitic infections

(6) Programme implications.

(1) **Impact of the school health package on the intestinal parasitic status of the schooler**

Overall Impact

As stated earlier in Section Two on "The Prevalence and Severity of intestinal parasitic infections in the Study Population", we had assessed the "Before" and "After" impact of mass deworming in two ways :

(a) In the Sentinel Study (Sentinel Study Report 1995), in Baroda Urban **only**, where stool examinations were possible, **the overall prevalence of helminthic and protozoal infections in a representative schooler population was as high as 71%**. This prevalence level was **significantly reduced to 40%** six to nine months later, after the mass administration of a single dose of 400 mg albendazole to the schoolers. In a similar fashion **helminthic infections were significantly reduced from 24% to 5%; and protozoal infections were significantly reduced from 55% to 35%** (Table 20). We feel that this is the true picture and is more reliable than the responses we obtained by **detailed questioning** of nearly 6000 schoolers in the Baseline survey and Resurvey. Facilities do **not** exist for mass screening and compliance is very poor (Gujral and Gopaldas 1995).

(b) However, even "questioning" schoolers for a positive history of passing **any worm** visible to the naked eye, **also showed a significant reduction in the prevalence of helminthic infections from 40% to 32%** (Table 21).

Table 20

Prevalence of intestinal parasitic infections by stool examination in schoolers (6-15 years) before and six months after mass deworming with a single dose (400 mg) of albendazole in Urban Baroda

Infection	Non-dosed group[a]		Dosed group	
	N	%	N	%
Sample size	181	-	83	-
Infected	128	71[a]	33	40[b]
Helminthic infection	43	24[a]	4	5[b]
Protozoal infection	99	55[a]	29	35[b]

[a] Sentinel Study Report (1995)
Figures having different superscript in the same row are significantly different from each other

Table 21

Impact of health inputs on the prevalence of helminthic infections as stated by schoolers (6-15 years) in the Resurvey covering the three study districts

Variables	Baseline		Resurvey	
	N	%	N	%
All children	1141 (2872)	40[a]	963 (2964)	32[b]
By age group				
6-10	633 (1478)	43[a]	560 (1561)	36[b]
11-15	508 (1394)	36[a]	403 (1403)	29[b]
By Sex				
Boy	549 (1395)	39[a]	465 (1468)	32[b]
Girls	592 (1477)	40[a]	498 (1496)	33[b]
By location				
Urban	614 (1455)	42[a]	477 (1535)	31[b]
Rural	527 (1417)	37	486 (1429)	34

Figures in parenthesis denote sample size
Figures having different superscript in the same row are significantly different from each other

Agewise, a larger proportion of younger (6-10 years) age schoolers as compared to their older (11-15 years) age counterparts claimed to be intestinal parasitic infected at the Baseline survey (43% vs 36%). At the Resurvey significant reductions were observed at both the age groups (43% to 36% in the younger and 36% to 29% in the older age groups). The magnitude of the reduction in the helminthic infections, however, did not vary by age (Table 21), these findings indicate that in actual numbers, more younger than older schoolers were free of worms at the Resurvey. This was attributed to the fact that a larger proportion of the former as compared to the latter had received the health inputs (Table 10).

Sexwise, no appreciable variations were observed in the prevalence of intestinal parasitic infections at both the surveys. Again from the Baseline survey to the Resurvey significant reductions were recorded in both boys (39% to 32%) as well as girls (40% to 33%) with no gender variations in the magnitude of decrease in the intestinal parasitic infection (Table 21).

Locationwise, the prevalence of intestinal parasitic infections did not significantly vary between the Urban and the Rural schoolers at both the surveys. The decreases (Table 21) from the Baseline survey to the Resurvey in intestinal parasitic infections were significant in the Urban (42% to 31%) and non-significant in the Rural (37% to 34%) schoolers. This could perhaps be attributed to the higher coverage and receipt of the health inputs in the Urban schools (Table 7).

The beneficial effects of albendazole in controlling/reducing intestinal helminthic and protozoal infections have been reported earlier. Stephenson et al (1989) divided 150 intestinal helminth infected children into control (72 children) and albendazole dosed (78 children) groups. Stool examination was done before and 6 months after a single dose of 400 mg albendazole. Prevalence of hookworm infection decreased from 95% to 77%, of Trichuris from 98% to 91% and of Ascaris from 44% to 13%. Likewise, in 1990, Chhotray and Ranjit had observed reductions in helminthic infections from 16% to 3% and in protozoal infections from 34% to 11%, 6 months after anthelmintic and antiprotozoal treatments were given to 297 schoolers. Much earlier, Gopaldas et al (1983) had reported reductions in helminthic (20% to 0%) and protozoal (25% to 13%) infections in response to anthelmintic and antiprotozoal treatment in 5 to 9 years old girls.

(2) Impact of health inputs on the haemoglobin status of intestinal parasite infected and not-infected schoolers

In both the surveys (Table 22), the mean haemoglobin levels of infected schoolers did not vary from their not-infected counterparts. However, earlier in our Sentinel Study (Sentinel Study Report 1995) where stool samples of 234 school children were examined for intestinal parasitic infections, the haemoglobin levels of infected schoolers were significantly lower than those of not-infected schoolers (10.4 vs 11.6 g/dl).

In response to the health inputs including albendazole (Table 22), the haemoglobin levels significantly improved in both boys as well as girls whether they were intestinal parasite infected (10.7±0.07 to 12.0±0.06 g/dl in boys and girls) or not (10.7±0.05 to 11.8±0.05 g/dl in boys and 10.4±0.05 to 11.6±0.04 g/dl in girls). Although the improvement in haemoglobin levels could mainly be ascribed to iron supplementation, the positive effects of albendazole on haemoglobin levels can not be ruled out.

Table 22

Impact of health inputs on the mean haemoglobin levels (g/dl) of intestinal parasite infected and not-infected schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts

Variables	Baseline						Resurvey					
	Infected			Not-Infected			Infected			Not-Infected		
	N	Mean	SEM	N	Mean	SEM	N	Mean	SEM	N	Mean	SEM
Boys	463	10.7^{a}	.07	764	10.7^{a}	.05	450	12.0^{b}	.06	990	11.8^{b}	.05
Girls	481	10.7^{a}	.07	761	10.4^{a}	.05	490	12.0^{b}	.06	986	11.6^{b}	.04
Total	944	10.7^{a}	.05	1525	10.5^{a}	.04	940	12.0^{b}	.05	1976	11.7^{b}	.03

Figures under each matching head having different superscript in the same row between the surveys are significantly different from each other

Many investigators have reported that helminthic as well as protozoal infections cause anaemia (Gopaldas et al 1985; Gujral and Chattopadhyay 1985; Gopaldas et al 1986; Cooper and Bundy 1986; Plorde and Ramsey 1991). However Shah and Seshadri (1985) had observed no significant differences between the haemoglobin levels of infected and non-infected preschoolers although within the anaemic group the haemoglobin levels of infected children were significantly lower than their non-infected counterparts. Similar findings that poor iron status adversely affects haemoglobin status in parasitized children, had earlier been reported by Hussein et al (1981). Positive responses of health inputs on haemoglobin levels of schoolers has also been reported by Gopaldas et al (1983b). They had reported significant improvements in the haemoglobin levels over the Baseline values in the 5-9 years old girls whether an anthelmintic and antiprotozoal was given alone or alongwith iron and vitamin A supplementation. After 4 months the mean haemoglobin levels of a group that received anthelmintic + iron + vitamin A was higher than the group that had received anthelmintic alone (10.70 vs 10.0 g/dl) and 8 months later it was 10.73 versus 9.96 g/dl. Similarly Kanani (1984) had reported significant increases in haemoglobin levels over the Baseline values in a group of 5-15 years old schoolers who received either anthelmintic alone (0.73 g/dl) or anthelmintic + iron + vitamin A supplementation (1.04 g/dl). The increases however, were higher in the latter group.

(3) Impact of the health inputs on the morbidity status of intestinal parasite infected and not-infected schooler

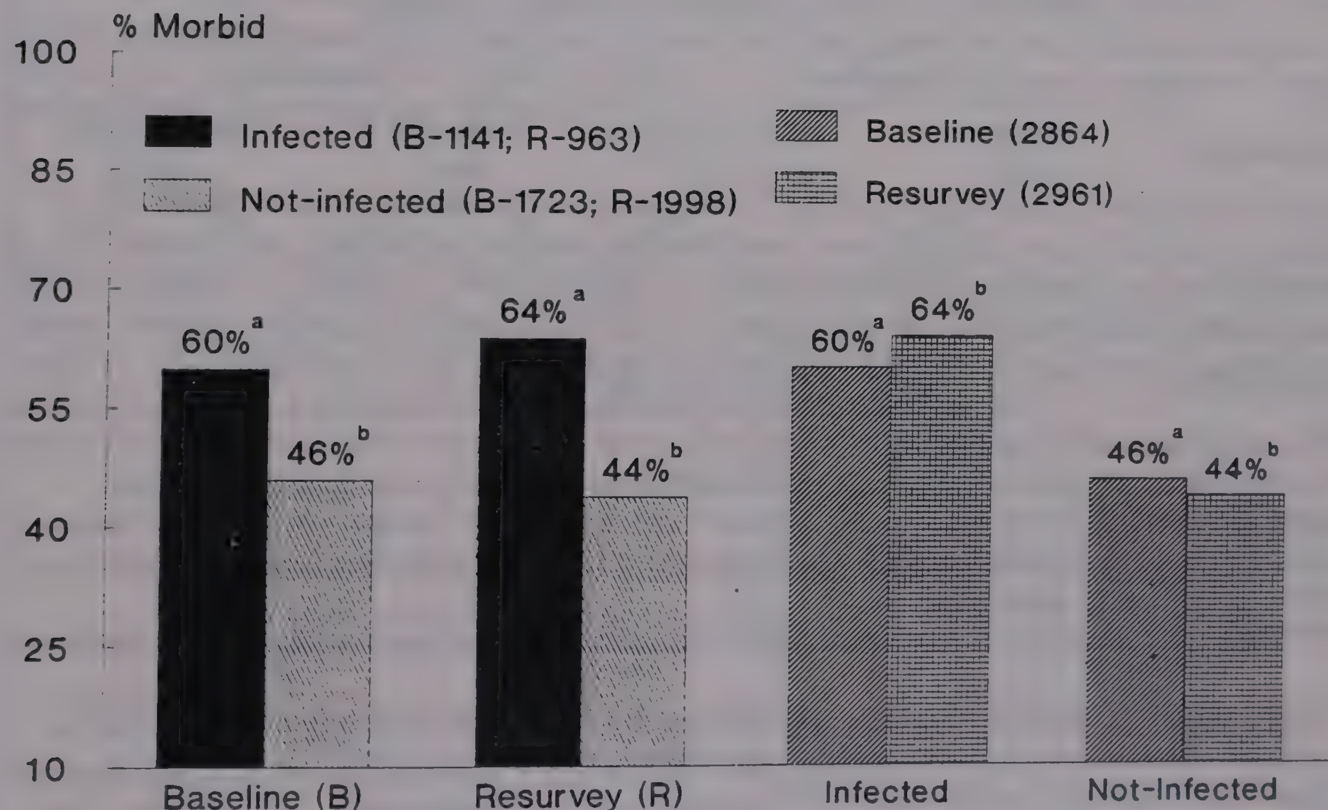
For the assessment of morbidity status, the schoolers were asked whether they suffered from severe diarrhoea, severe dysentery, upper respiratory tract infection, acute respiratory tract infection, typhoid and malaria in the past two months (for definitions see page 30).

Within each survey, a significantly larger percentage of infected (60% vs 46%) than not-infected (64% vs 44%) schoolers were morbid (Figure 7).

Six to nine months after receiving the health inputs significant improvement was recorded in morbidity status of the not-infected schoolers (46% to 44%). In infected schoolers however opposite trends were observed. A significantly larger proportion of the infected schoolers were morbid at the Resurvey as compared to at the Baseline survey (64% vs 60%).

Figure 7

Morbidity profile of helminthic infected and not-infected schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts



Figures in parentheses denote sample size

Figures under each head having different superscript are significantly different from each other

(4) **Impact of the health inputs on the prevalence of xerophthalmia among intestinal parasite infected schooler :**

The prevalence of xerophthalmia (Table 23) was significantly higher in infected versus not-infected schoolers at the Baseline survey (58% vs 40%) than at the Resurvey (28% vs 19%). Excluding X1A sign however, these differences disappeared.

In response to health inputs, the prevalence of xerophthalmia including or excluding conjuctival xerosis (X1A) significantly decreased from its respective Baseline value (Table 23) in both infected (58% to 28%) and not-infected (40% to 19%) schoolers. This might mainly be due to vitamin A supplementation.

Table 23

Impact of health inputs on the prevalence of xerophthalmia in intestinal parasite infected and not-infected schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts

Xerophthalmia	Baseline				Resurvey			
	Infected (1141)		Not-infected (1723)		Infected (963)		Not-infected (1998)	
	N	%	N	%	N	%	N	%
Including X1A	665	58^{a}	689	40^{b}	266	28^{a}	387	19^{b}
Excluding X1A	119	10^{a}	159	9^{b}	38	4^{a}	93	5^{b}
No xerophthalmia	476	42	1034	60	697	72	1611	81

Figures in parentheses denote sample size
Figures having different superscript within survey between infected and not infected are significantly different from each other
Figures under each matching head having different superscript in the same row between surveys are significantly different from each other

Earlier, Bakshi (1989) had dosed school boys (9-15 years) with 200,000 IU vitamin A with or without anthelmintic (500 mg pyrantel pamoate) every 4 months for one year. At baseline 18% children of 'vitamin A dosed' and 23% children of the 'vitamin A + anthelmintic group' exhibited xerophthalmia. She observed that anthelmintic therapy did not augment mega vitamin A dosing in reducing the overall prevalence of xerophthalmia. However, in her study the prevalence of active signs and of overall Bitot's Spots (X1B) improved earlier in the group receiving anthelmintic therapy alongwith vitamin A than the group that received only vitamin A. Much earlier Araujo et al (1978) had observed that massive doses of vitamin A to vitamin A deficient children **did not** improve their serum vitamin A levels unless additional antiparasitic treatment was given. Kanani (1984) reported a 17% reduction in ocular signs of vitamin A deficiency, in schoolers receiving deworming, iron and vitamin A over one school year. Recent studies in Nepal and Brazil have shown increases of 50% in serum retinol levels in deparasitized children (Nelson 1992).

(5) **Impact of the health inputs on nutritional anthropometry of intestinal parasite infected and not-infected schooler :**

Growth pattern of infected and not-infected schooler at the Baseline survey and Resurvey :

The growth pattern by weight-for-age and height-for-age of intestinal worm infected and not-infected school boys and girls (6-15 years) is presented in Figures 8 and 9 respectively.

At the Baseline survey (before the supplementation of the health inputs programme) the growth of parasite infected schoolers (both boys and girls) was slower (only by weight) than their not-infected counterparts. The curves for weight-for-age as well as height-for-age of the Baseline survey infected schoolers tended to trail behind their corresponding not-infected counterparts.

At the Resurvey (6 to 9 months after implementation of the health inputs programme) the rate of growth (by weight and height) improved of both infected and not-infected (boys and girls) schoolers. The improvement in growth, however, was more marked in older (11-15 years) than younger (6-10 years) age schoolers. On an average, the younger age infected schoolers were heavier by 0.6 kg (18.6 vs 19.2 kg) and the older by 1.0 kg (27.0 vs 28.0 kg) (Table 24). Similarly, the younger not-infected schooler was heavier by 0.8 kg and the older by 1.5 kg.

A similar trend was observed in height (Table 24). At the Resurvey as compared to that at the Baseline survey, the younger age infected schoolers were taller by 0.4 cm (117.8 vs 118.2 cm) and the older infected by 1.1 cm (137.7 vs 138.8 cm). The corresponding differences in the not-infected younger schooler were to the tune of 1.4 cm (117.2 vs 118.6 cm) and in the older schoolers 2.1 cm (137.8 vs 139.9 cm). The differences in the mean weight and height of infected and not-infected schoolers between the Baseline survey and Resurvey were statistically significant (Table 24).

Table 24

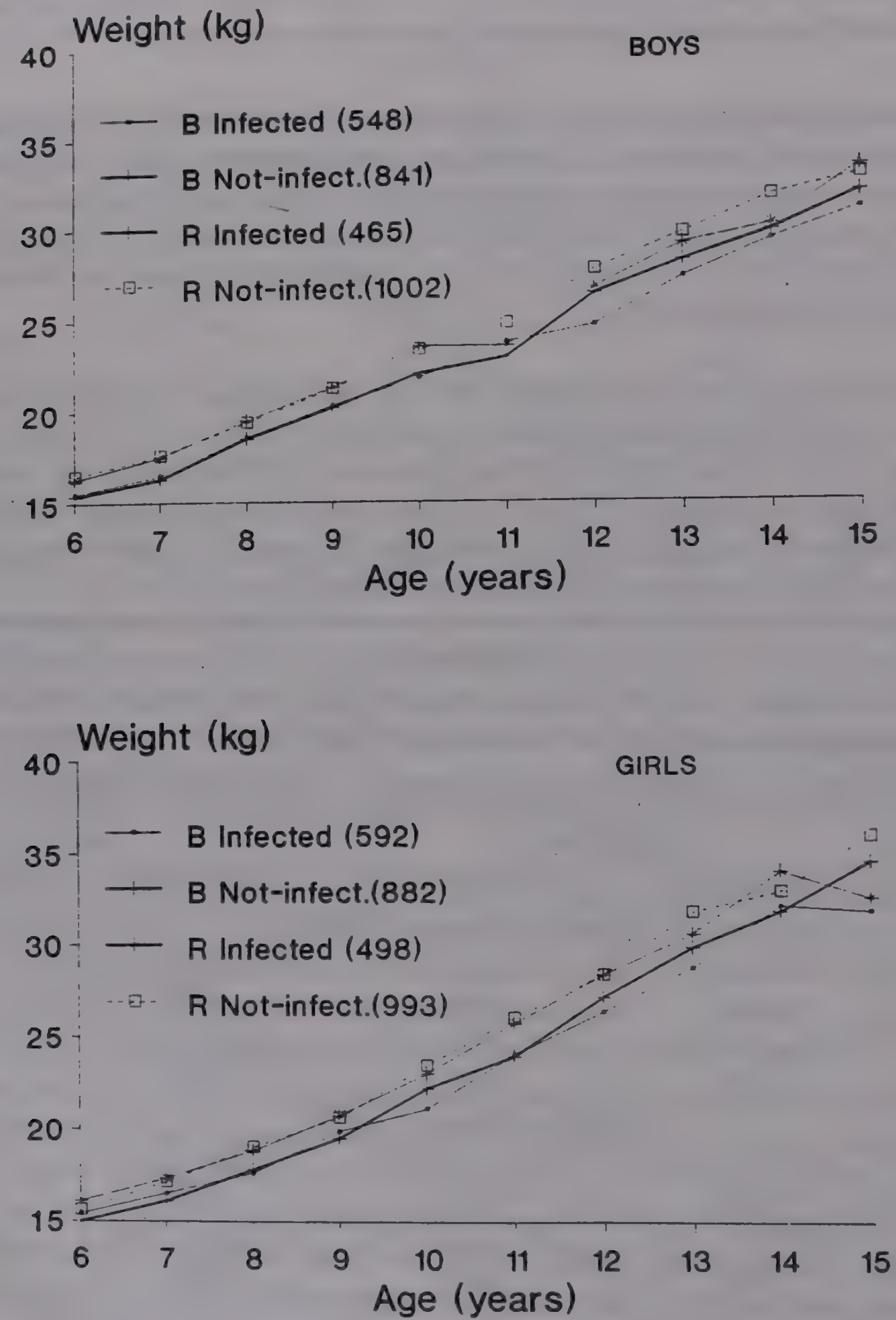
Impact of health inputs on the mean weight (kg) and height (cm) of intestinal parasite infected and not-infected schoolers (6-15 years) by age groups in the Baseline and Resurvey covering the three study districts

Age groups	Baseline		Resurvey	
	Infected	Not-infected	Infected	Not-infected
Weight (Mean + SEM)				
6 - 10 years	18.6 ± 0.13^{a} (632)	18.6 ± 0.12^{a} (840)	19.2 ± 0.15^{b} (607)	19.4 ± 0.14^{b} (1099)
11 - 15 years	27.0 ± 0.24^{a} (508)	27.5 ± 0.18^{a} (883)	28.0 ± 0.28^{b} (356)	29.0 ± 0.19^{bc} (896)
Height (Mean + SEM)				
6 - 10 years	117.8 ± 0.34 (632)	117.2 ± 0.33^{a} (840)	118.2 ± 0.36 (607)	118.6 ± 0.28^{b} (1098)
11 - 15 years	137.7 ± 0.39^{a} (508)	137.8 ± 0.32^{a} (883)	138.8 ± 0.46^{b} (356)	139.9 ± 0.30^{b} (896)

Figures in parentheses denote sample size
Figures under each matching head having different superscript in the same row between surveys are significantly different from each other
Figures having different superscript in the same row within surveys are significantly different from each other

Figure 8

Growth patterns of infected and not-infected schoolers (6-15 years) by weight-for-age in the Baseline and Resurvey covering the three study districts

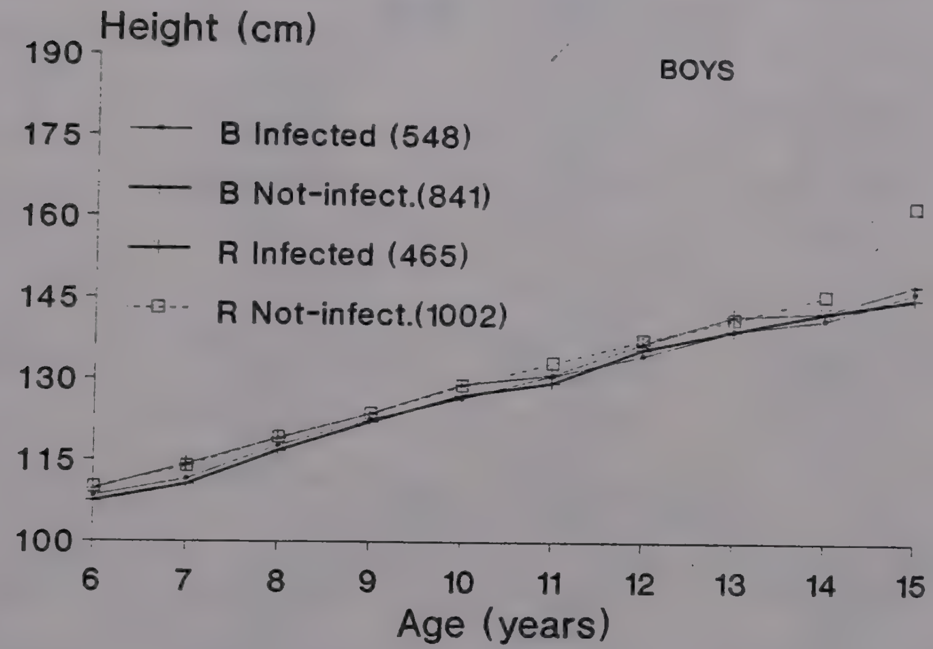


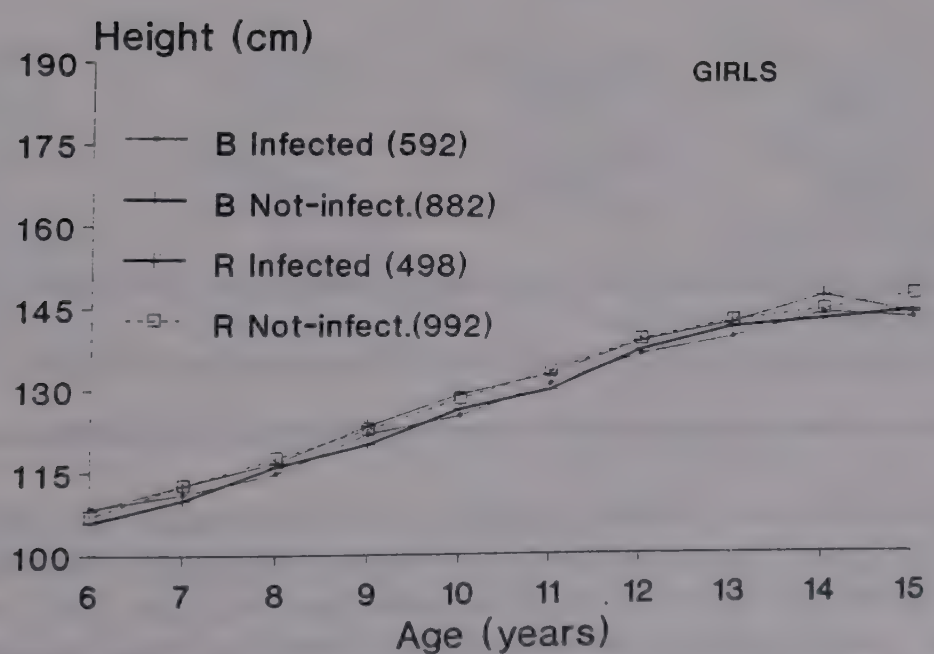
Figures in parentheses denote sample size

B = Baseline, R = Resurvey

Figure 9

Growth patterns of infected and not-infected schoolers (6-15 years) by height-for-age in the Baseline and Resurvey covering the three study districts





Figures in parentheses denote sample size

B = Baseline, R = Resurvey

Sexwise no differences were observed in mean weight and height of infected versus not-infected younger (6-10 years) as well as older (11-15 years) age schoolers at both the surveys (Table 25a).

Table 25a

Impact of health inputs on the mean weight (kg) and height (cm) of intestinal parasite infected and not-infected schoolers (6-15 years) by sex in the Baseline and Resurvey covering the three study districts

By sex	Baseline		Resurvey	
	Infected	Not-infected	Infected	Not-infected
Weight (Mean ± SEM)				
BOYS				
6 - 10 years	18.8 ± 0.18 (312)	18.7 ± 0.17^{a} (404)	19.3 ± 0.23 (292)	19.7 ± 0.15^{b} (551)
11 - 15 years	26.5 ± 0.33 (236)	26.9 ± 0.24^{a} (437)	27.3 ± 0.39^{a} (173)	28.4 ± 0.26^{b} (451)
GIRLS				
6 - 10 years	18.4 ± 0.17^{a} (320)	18.5 ± 0.18^{a} (436)	19.2 ± 0.20^{b} (315)	19.2 ± 0.17^{b} (548)
11 - 15 years	27.5 ± 0.33^{a} (272)	28.2 ± 0.27^{a} (446)	28.7 ± 0.40^{ab} (183)	29.7 ± 0.28^{b} (445)
Height (Mean ± SEM)				
BOYS				
6 - 10 years	118.1 ± 0.47 (312)	117.6 ± 0.47^{a} (404)	118.3 ± 0.52 (292)	119.3 ± 0.38^{b} (551)
11 - 15 years	137.6 ± 0.58 (236)	137.1 ± 0.46^{a} (437)	138.4 ± 0.67 (173)	139.6 ± 0.44^{b} (451)
GIRLS				
6 - 10 years	117.5 ± 0.48 (320)	116.9 ± 0.47 (436)	118.1 ± 0.51 (315)	117.9 ± 0.42 (547)
11 - 15 years	137.8 ± 0.52 (272)	138.4 ± 0.45^{a} (446)	139.2 ± 0.63 (183)	140.3 ± 0.40^{b} (445)

Figures in parentheses denote sample size

Figures under each matching head having different superscript in the same row between and within surveys are significantly different from each other

Figures having different superscript in the same row within surveys are significantly different from each other

Locationwise (Table 25b) the Urban infected schoolers, both younger and older boys and girls were lighter by 0.2 kg to 2.0 kg than their not-infected counterparts at both the surveys. No such consistent trends were observed in Rural schoolers. In height also no clear cut differences were seen between infected and not-infected Urban and Rural schoolers at the Baseline survey. At Resurvey, although non-significantly, the Urban not-infected schoolers were taller than their Rural counterparts.

Table 25b

Impact of health inputs on the mean weight (kg) of intestinal parasite infected and not-infected schoolers (6-15 years) by location in the Baseline and Resurvey covering the three study districts

By location	Baseline		Resurvey	
	Infected	Not-infected	Infected	Not-infected
	Mean ± SEM			
URBAN				
Boys				
6 - 10 years	18.8 ± 0.24^{a} (170)	19.0 ± 0.24^{a} (182)	19.3 ± 0.34^{b} (153)	19.7 ± 0.20^{b} (299)
11 - 15 years	26.5 ± 0.45^{a} (125)	27.6 ± 0.35^{b} (232)	27.7 ± 0.65 (75)	28.8 ± 0.39^{a} (224)
Girls				
6 - 10 years	18.9 ± 0.24 (171)	18.6 ± 0.24^{a} (193)	19.5 ± 0.25 (174)	19.4 ± 0.22^{b} (290)
11 - 15 years	27.8 ± 0.45^{a} (148)	29.2 ± 0.38^{b} (228)	28.8 ± 0.59^{a} (75)	30.8 ± 0.37^{bc} (242)
RURAL				
Boys				
6 - 10 years	18.8 ± 0.27 (142)	18.5 ± 0.24^{a} (222)	19.3 ± 0.30 (139)	19.6 ± 0.23^{b} (252)
11 - 15 years	26.5 ± 0.50 (111)	26.0 ± 0.32^{a} (205)	27.0 ± 0.49 (98)	27.9 ± 0.34^{b} (227)
Girls				
6 - 10 years	17.9 ± 0.25 (149)	18.3 ± 0.25^{a} (243)	18.8 ± 0.32 (141)	19.0 ± 0.25^{b} (258)
11 - 15 years	27.2 ± 0.49^{a} (124)	27.2 ± 0.38^{a} (218)	28.7 ± 0.54^{b} (108)	28.4 ± 0.40^{b} (203)

Figures in parentheses denote sample size
Figures under each head having different superscript in the same row between and within surveys are significantly different from each other
Figures having different superscript in the same row within surveys are significantly different from each other

Ignoring the infection status, no specific trends in growth over the 6 to 9 months period (Baseline survey to Resurvey) were observed in the younger age group, but in the older age group, Urban schoolers (both boys and girls) particularly the not-infected ones, were heavier by 1 to 2 kg and taller by 1 cm than their Rural counterparts (Tables 25b,c). This was not surprising because the coverage for all the three health inputs was higher in the Urban than in the Rural schoolers (Table 8).

Table 25c

Impact of health input on the mean height (cm) of intestinal parasite infected and not-infected schoolers (6-15 years) by location in the Baseline and Resurvey covering the three study districts

Location	Baseline		Resurvey	
	Infected	Not-infected	Infected	Not-infected
	Mean ± SEM			
URBAN				
Boys				
6 - 10 years	117.5 ± 0.63 (170)	117.6 ± 0.68 (182)	117.5 ± 0.72 (153)	119.2 ± 0.52 (299)
11 - 15 years	137.6 ± 0.84 (125)	137.6 ± 0.68[a] (232)	138.0 ± 1.09 (75)	139.9[b] ± 0.63 (224)
Girls				
6 - 10 years	117.2 ± 0.67 (171)	116.6 ± 0.65 (193)	118.2 ± 0.66 (174)	117.7 ± 0.56 (289)
11 - 15 years	137.9 ± 0.73 (148)	138.9 ± 0.63[a] (228)	138.9 ± 1.04 (75)	140.9[b] ± 0.56 (242)
RURAL				
Boys				
6 - 10 years	118.8 ± 0.71 (142)	117.6 ± 0.65[a] (222)	119.1 ± 0.76 (139)	119.6 ± 0.56[b] (252)
11 - 15 years	137.7 ± 0.79 (111)	136.6 ± 0.62[a] (205)	138.7 ± 0.83 (98)	139.2 ± 0.61[b] (227)
Girls				
6 - 10 years	117.9 ± 0.71 (149)	117.1 ± 0.66 (243)	118.1 ± 0.78 (141)	118.2 ± 0.62 (258)
11 - 15 years	137.7 ± 0.72 (124)	137.9 ± 0.64 (218)	139.4 ± 0.80 (108)	139.7 ± 0.58[b] (203)

Figures in parentheses denote sample size
Figures under each head having different superscript in the same row between surveys are significantly different from each other

The findings that the growth of schoolers, whether worm infected or not, improved in response to health inputs is supported by the observations made with respect to schoolers whose stool samples were examined for intestinal parasitic infections.

The stool samples of 83 schoolers who said they pass worms in their feces and **had** received the health inputs (treated group) and were cooperative, were tested for intestinal parasitic infections. Fifty of the stool samples tested negative; and the remaining 33 tested positive. The mean weight and height of all the schoolers **significantly improved** over their Baseline values despite the fact that 40% of the 83 schoolers were still infected (Table 26). The improvement in growth rate could partly be attributed to the improvement in appetite of the schoolers, because on a KAP rating for their physical well being after taking the health inputs,

23% schoolers said that their appetite had improved and that they ate more than they had previously.

Significant increment in height, six months after anthelmintic treatment in 595 (2-12 years old) children from Myanmar has been reported by Thein-Hlaing et al (1991). Weight increased significantly but 24 months after the treatment. These findings were attributed to the fact that in response to periodic treatment, growth in height in schoolers was favoured first at the expense of weight which relies on a satisfactory positive balance of nutrients and/or energy (Cooper et al 1990). An year earlier Stephenson et al (1989) had observed significant increases in weight and height of Kenyan school children six months after treatment with a single dose of albendazole.

Table 26

Impact of health inputs on the mean weight and height of 83 schoolers (6-15 years) before and after deworming and micronutrient supplementation

Variables	Baseline	Resurvey
	Mean ± SEM	
Weight (kg)	$21.9^{a} \pm 0.56$	$23.5^{b} \pm 0.58$
Height (cm)	$124.7^{a} \pm 1.19$	$127.9^{b} \pm 1.18$

Figures having different superscript in the same row are significantly different from each other

In nutshell, it appears that the implementation of the health inputs programme significantly reduced the intestinal worm infections in schoolers and significantly improved their nutritional status.

(6) Programme Implications

1. **We restate (please see Programme Implications, Section Two) that intestinal parasitic infections constitute a *major public health problem in the under-privileged schooler* and needs to be urgently addressed. Health and Nutrition Policy should recommend that Intestinal Parasite Control be made a National programme for *all under-privileged communities*, and for the *Schooler in particular*.**
2. **Bi-annual mass preventive anthelmintic dosing is indicated to be necessary. The Urban Schoolers who got two dosing rounds in one school year showed a *significant reduction* in intestinal parasite levels vs the Rural schoolers who got one dosing and did *not* show a significant reduction in prevalence.**
3. **Schoolers who received the School Health Package were in a significantly better nutritional status, namely, growth and haemoglobin concentrations were up; and prevalence of vitamin A deficiency and intestinal parasitic infections were down. The greatest perceived benefit among the infected schoolers was to be *rid of the worms*. This reinforces our recommendation to integrate the School Health Package into the on-going National Mid-Day-Meal Programme.**
4. **The country should make provision to manufacture its own requirements for the said School Health Package. Sustainability cannot otherwise be ensured.**

SECTION SIX : IMPACT OF THE SCHOOL HEALTH PACKAGE ON THE VITAMIN A STATUS OF THE SCHOOLERS

Section Six includes :

1. Impact of the health inputs on the prevalence of ocular signs of vitamin A deficiency (Xerophthalmia)
2. Impact of the health inputs on the prevalence of IDA in relation to xerophthalmia
3. Impact of the health inputs on the morbidity status of schooler in relation to xerophthalmia
4. Impact of the health inputs on the growth of schooler in relation to xerophthalmia
5. Programme implications.

(1) Impact of the health inputs on the prevalence of ocular signs of vitamin A deficiency (Xerophthalmia)

All schoolers at the Baseline survey and Resurvey were clinically examined for vitamin A deficiency ocular signs.

At the Baseline survey (Table 27) nearly one-half of the schooler exhibited one or more signs of vitamin A deficiency. A larger proportion (45%) of those having signs exhibited conjunctival xerosis alone or in combination with other signs. Bitot's spot was seen in 6% schoolers. Four percent schoolers gave a history of night-blindness. The severe forms of vitamin A deficiency were seen in less than 1% of the schoolers because older children generally manifest milder signs mainly affecting the conjunctiva (Sommer 1995). One percent of the schoolers showed more than one sign along with night-blindness and hence were considered as "active cases". These data point to the fact that **in the study population vitamin A deficiency was of public health concern**.

Table 27
Impact of health inputs on the vitamin A status by ocular signs of schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts

Vitamin A Deficiency Ocular Signs	Baseline		Resurvey	
	N	%	N	%
No sign	1481	52[a]	2308	78[b]
Any one sign	1356	48[a]	656	22[b]
Conjunctival xerosis (XIA)	1277	45[a]	584	20[b]
Bitot's spot (XIB)	184	6[a]	48	2[b]
Corneal xerosis (X2)	2	< 1	0	-
Night-blindness (XN)	106	4	91	3
Active signs	32	1	22	< 1

Active signs include = Night-blindness + Conjunctival xerosis or/and Bitot's spots
Figures having different superscript in the same row between surveys are significantly different from each other
Percentage will not total to hundered because some children had Conjunctival xerosis + Bitot's spot

In response to the health inputs which included a six-monthly dose of 200,000 IU vitamin A, the proportion of schoolers having vitamin A deficiency ocular signs significantly reduced from 48% to 22% (Table 27). Consequently the proportion of those having no signs significantly increased (52% to 78%). No schooler was seen to be having corneal xerosis while 20% schoolers still showed conjunctival xerosis and 2% Bitot's spots, though their proportions were

significantly smaller than those observed at the Baseline survey. Non-significant reductions were seen in night-blindness and in schooler who had active signs.

Since conjunctival xerosis (X1A) is considered a poor diagnostic criterion for xerophthalmia, prevalence of xerophthalmia excluding conjunctival xerosis in relation to age group, sex and location of schoolers was examined.

Age group-wise, at the Baseline survey as well as at the Resurvey more of older (11-15 years) than younger (6-10 years) schoolers tended to suffer from vitamin A deficiency (Table 28). The prevalence reduced significantly in response to health inputs in both the age groups.

Table 28
Impact of health inputs on the prevalence of xerophthalmia (excluding XIA) in relation to age group, sex and location in the Baseline and Resurvey covering the three study districts

Variables	Baseline		Resurvey	
	N	%	N	%
Age group				
6-10 years	135 (1466)	9[a]	69 (1708)	4[b]
11-15 years	144 (1371)	11[a]	62 (1256)	5[b]
Sex				
Boys	144 (1380)	10[a]	70 (1468)	5[b]
Girls	135 (1457)	9[a]	61 (1496)	4[b]
Location				
Urban	90 (1433)	6[a]	86 (1535)	6[a]
Rural	189 (1404)	13[b]	45 (1429)	3[c]

Figures in parentheses denote sample size
Figures having different superscript in the same row between surveys are significantly different from each other
Figures having different superscript in the same column between 'Locations', are significantly different from each other

Sexwise more of boys than girls tended to be xerophthalmic at both the surveys although the difference was not statistically significant. From Baseline survey to Resurvey, the prevalence of xerophthalmia significantly decreased from 10% to 5% in boys and from 9% to 4% in girls.

Locationwise, a significantly larger proportion of the Rural than the Urban schoolers were xerophthalmic at the Baseline survey (13% vs 6%). In response to health inputs, the percentage of xerophthalmia reduced significantly from 13% to 3% in the Rural schoolers while no reduction were observed in the Urban schoolers.

In a similar group of children in Baroda, vitamin A deficiency ocular signs were seen to range between 19% to 48% (Kanani and Gopaldas 1983, Gopaldas et al 1983a, Sharma 1984, Patel 1985, Pant and Gopaldas 1987, Bagga 1986, Gopaldas et al 1988, Bakshi 1989). The wide range in the presence of vitamin A deficiency ocular signs could be due to differences in season in which these studies were conducted. This hypothesis is based on the fact that in the Indian market, **vitamin A rich foods become available only in the season they are grown**. Bakshi (1989) had reported that the intake of vitamin A by schoolers varied from 98% of RDA in the summer months when mangoes were available to 47% in the monsoon season when much less of vitamin A rich foods were available in the markets. Besides out of season vitamin A rich fruits and vegetables, if available, remain

beyond the economic reach of the under-privileged community in particular. The highest prevalence of vitamin A deficiency in low income groups and during the lean season for vitamin A rich foods has also been reported by Mamdani and Ross (1988).

Higher vitamin A deficiency in older than younger schoolers had been reported by Pant and Gopaldas (1987). In their study, 49% of the younger (7-10 years) versus 69% of the older (11-15 years) age children showed vitamin A deficiency signs. The greater inadequacy of vitamin A in older (above 10 years) than younger (below 10 years) age children reported earlier (Kanani and Gopaldas 1983, Gopaldas et al 1983a, Kanani 1984, Pant 1986) might explain to some extent, the differences observed in the prevalence of xerophthalmia between older and younger children.

The trend that xerophthalmia is more prevalent in Rural than Urban schoolers was seen as early as 1977. Gupta and Saxena (1977) had observed that the prevalence of xerophthalmia was 16% in Rural and 9% in Urban children. Also the data of the National Nutrition Monitoring Bureau (1981) showed similar trends that more of Rural than Urban schoolers manifested vitamin A deficiency eye signs (29% vs 13%).

Boys being at a higher risk than girls has been reported by Gopaldas et al (1988) and Pant and Gopaldas (1986). Tielsch and Sommer (1984), DeMaeyer (1986) and Sommer (1995) feel that the difference might be due to cultural practices in rearing children and/or physiological differences.

(2) Impact of the health inputs on the prevalence of IDA in relation to xerophthalmia

The prevalence of IDA (Hb <12 g/dl) was almost universal. Eighty-four percent non-xerophthalmics and 90% xerophthalmics were iron-deficient anaemics (Figure 10). In response to health inputs, prevalence of anaemia significantly reduced by 31% (84% to 53%) in non-xerophthalmics and by 33% (90% to 57%) in xerophthalmics.

Vitamin A deficiency increases the risk of IDA (Mohanram et al 1977). It has been hypothesised that vitamin A deficiency impairs the utilization of iron by the body. Decreases in serum iron levels and increase in hepatic iron stores have been reported in vitamin A deficiency (Mejia et al 1977). Devadas and Saroja (1980) had reported significantly lower hematological status in vitamin A deficient subjects as compared to the controls. Vitamin A supplementation on the other hand, is known to improve absorption and utilization of iron (Mejia and Chew 1988) and thereby hematopoiesis (Viteri et al 1972).

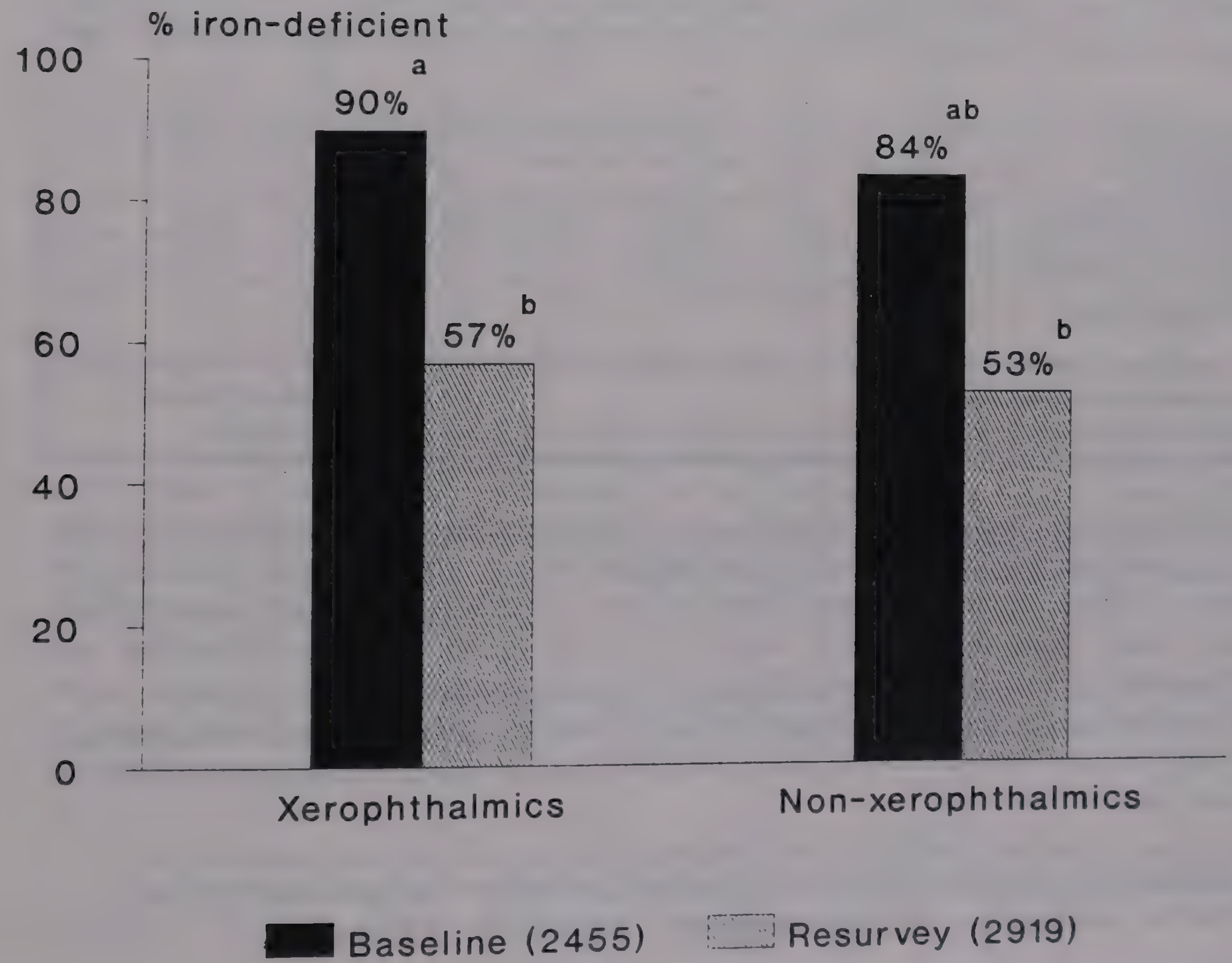
In the present evaluation since the schoolers received vitamin A capsule (200,000 IU) as well as iron tablets (60 mg elemental iron daily for 85 days) the observed findings viz reduction of IDA could be ascribed to the combined effect of both the nutrients.

(3) Impact of the health inputs on the morbidity status of the schoolers in relation to xerophthalmia

Records were maintained on the morbidity status of schoolers in the preceding two months. Morbidities considered were severe diarrhoea, severe dysentery, upper respiratory tract infection, acute respiratory tract infection and various types of fever viz malaria, typhoid and other fevers.

Figure 10

Percent iron-deficient schoolers (6-15 years) among xerophthalmics and non-xerophthalmics (excluding X1A) in the Baseline and Resurvey covering the three study districts



Figures in parentheses denote sample size

Figures having different superscript between and within surveys are significantly different from each other

Table 29 shows that at the Baseline little over half the schoolers were morbid (at least one morbidity in preceding two months) regardless of their being xerophthalmic or not. **Among the xerophthalmic-morbid-schoolers, a larger proportion (79%) had reported upper respiratory tract infections.** Nearly one-fourth had suffered from severe diarrhoea and/or were down with fever. A relatively small percentage of non-xerophthalmics tended to be morbid with diarrhoea and upper respiratory tract infection.

Table 29

Impact of health inputs on the morbidity profile of xerophthalmic and non-xerophthalmic schoolers (6-15 yrs) in the Baseline and Resurvey covering the three study districts

Morbidity Status	Baseline				Resurvey			
	No (1481)		Yes (1356)		No (2310)		Yes (654)	
	N	%	N	%	N	%	N	%
Not morbid	721	49	657	49[a]	1167	50	295	45[b]
Morbid	760	51	699	51[a]	1143	50	359	55[b]
Severe diarrhoea	165	22[a]	161	23[a]	124	11[b]	52	15[b]
Severe dysentery	15	2	11	2	24	2	2	-
Upper resp. tract infect.	446	59	550	79	761	67	252	70
Acute resp. tract infect.	2	-	2	-	1	-	1	-
Malaria/Typhoid/other Fevers	368	48[a]	174	25[a]	415	35[b]	112	30[b]

Figures in parentheses denote sample size
Figures having different superscript, between surveys are significantly different from each other

At the Resurvey (Table 29) a significantly larger proportion of xerophthalmics were morbid as compared to their counterparts at the Baseline survey (55% Vs 51%). This was due mainly to the significant increases in prevalence of fever. Significant reductions were recorded in diarrhoeal cases from the Baseline survey to Resurvey in both xerophthalmics and non-xerophthalmics. Likewise, the proportion of xerophthalmics who had reported upper respiratory tract infections decreased though non-significantly, in response to health inputs. In non-xerophthalmics on the other hand, upper respiratory tract infections increased from the Baseline survey to the Resurvey.

> It appears that inclusion of vitamin A in the health inputs package aided in reducing morbidities particularly of diarrhoea and upper respiratory tract infections.

Both mild and severe forms of vitamin A deficiency are associated with increased morbidity especially from respiratory and diarrhoeal diseases (Sommer et al 1984). Bakshi (1989) in an evaluation similar to the present evaluation, had also found lower overall morbidity (expressed as percent illness per week) in non-xerophthalmics than xerophthalmics (33% vs 46%). Upper respiratory tract infection (29% vs 43%) and fever (8% vs 11%) cases were also smaller in the former than the latter groups. Only 3% children had diarrhoea in xerophthalmics while none reported to have diarrhoea in the non-xerophthalmics. More recently, Gopaldas et al (1992) reported almost similar differences in prevalence of morbidity in the

xerophthalmics (50%) and non-xerophthalmics (39%) in school children belonging to the similar socio-economic background as of the present evaluation. Somewhat similar to our findings on the impact of vitamin A supplementation have been reported by Bakshi (1989). The author had supplemented school children with 200,000 IU vitamin A every four months for one year. Diarrhoeal morbidity decreased from 2% to 1% and upper respiratory tract infections from 33% to 31% while fever morbidity as observed in the present evaluation increased from 9% to 15%. The changes in various morbidities were observed following a second or third dose of vitamin A supplementation. However, comparing the morbidity status of a vitamin A supplemented and a placebo group, the author reported reductions in overall morbidity from 53% to 41% and in upper respiratory tract morbidity from 39% to 31%.

Likewise Gopaldas et al (1992) had reported that the prevalence overall morbidity reduced from 43% to 34% in the vitamin A supplemented while it increased from 37% to 40% in the placebo group. Similarly morbidity with upper respiratory tract infection decreased from 34% to 9% in the vitamin A supplemented group and increased from 27% to 33% in the placebo group. Contrary to our findings, significant reductions were observed in fever morbidity in the supplemented group. The study concluded that vitamin A supplementation curbed/restrained the prevalence of common childhood morbidities.

Much earlier Khan et al (1984) had found that 86% xerophthalmia was related to diarrhoea. Two years later Stanton et al (1986) reported an association between diarrhoea and mild xerophthalmia. Stoll et al (1985) had earlier suggested that diarrhoea can be a risk factor for xerophthalmia than vice versa. More recently the relative risk for the occurrence of diarrhoea along with vitamin A deficiency in preschoolers was reported to be nearly two times (Gujral et al 1993).

(4) Impact of the health inputs on the growth of schoolers in relation to xerophthalmia

The mean weight and height of younger (6-10 years) and older (11- 15 years) age schoolers did not significantly vary between xerophthalmics and non-xerophthalmics at both the surveys (Table 30). But from the Baseline survey to the Resurvey both xerophthalmics and non-xerophthalmics added about 1 to 2 kg in weight and about 1 to 2 cm in height. The gains were statistically significant mainly in the non-xerophthalmics (Table 30).

Although vitamin A has been associated with growth (McCollum and Davis 1915) and vitamin A supplementation with improvement in growth (WHO 1979) there is a dearth of data on the role of vitamin A in promoting growth in school children.

In accordance with our findings Pant (1986) reported significant increases in weight and height of the placebo and the vitamin A supplemented younger (7-10 years) as well as older (11-15 years) age children.

Earlier in 1981, Pirie and Abunathan supplemented malnourished xerophthalmic children who were admitted to the Nutrition Rehabilitation Centre, with 50000 IU or 100000 IU vitamin A daily for 3-4 days. Children who received a lower dose gained more weight than those who received a higher dose. Weight gain however was not related to the nutritional grade of the children at admission. It was also reported that children manifesting clinical ocular signs of vitamin A deficiency were more malnourished than those with no clinical signs.

Table 30

Impact of health inputs on the mean weight (kg) and height (cm) of xerophthalmic (excluding XIA)/non-xerophthalmic schoolers (6-15 years) by age in the Baseline and Resurvey covering the three study districts

Age groups	Baseline	Resurvey
	Weight (Mean ± SEM)	
6-10 years		
Xerophthalmics	18.9 ± 0.27 (135)	19.2 ± 0.43 (69)
Non-xerophthalmics	18.6 ± 0.09[a] (1330)	19.4 ± 0.09[b] (1638)
11-15 years		
Xerophthalmics	27.6 ± 0.40[a] (144)	29.4 ± 0.60[b] (62)
Non-xerophthalmics	27.3 ± 0.16[a] (1227)	28.7 ± 0.16[b] (1192)
	Height (Mean ± SEM)	
6-10 years		
Xerophthalmics	118.7 ± 0.74 (135)	118.3 ± 1.12 (68)
Non-xerophthalmics	117.3 ± 0.25[a] (1330)	118.5 ± 0.23[b] (1638)
11-15 years		
Xerophthalmics	138.7 ± 0.67 (144)	140.6 ± 1.08 (62)
Non-xerophthalmics	137.5 ± 0.27[a] (1227)	139.6 ± 0.26[b] (1192)

Figures in parentheses denote sample size
Figures having different superscript in the same row are significantly different from each other

In conclusion, prevalence of vitamin A deficiency ocular signs significantly decreased from the Baseline survey to the Resurvey (48% to 22%). Significant reductions in diarrhoeal cases (23% to 15%) and non-significant reductions (79% to 70%) in upper respiratory tract infections were also observed. Growth of schoolers improved from the Baseline survey to the Resurvey, but the growth pattern did not differ between xerophthalmics and non-xerophthalmics.

(5) Programme Implications

1. **It is very necessary to give a minimum School Health Package (SHP) of anthelmintic, vitamin A and iron *together* for maximum positive synergy.**

2. **Since vitamin A aids in controlling common morbidities such as GIT and URI infections, which may contribute to school absenteeism, it is essential it is included in the SHP.**

SECTION SEVEN : IMPACT OF THE SCHOOL HEALTH PACKAGE ON THE GROWTH OF THE SCHOOLER

Section Seven includes :

1. Impact of the Health Inputs on the Growth Pattern by Weight and Height of the Schooler
2. Impact of the Health Inputs on the Body Mass Index of the Schooler
3. Impact of the Health Inputs on the Nutritional Status of Schooler by Height-for-Age Index
4. Programme Implications.

(1) Impact of the health inputs on the growth pattern by weight and height of the schooler

Growth pattern

The growth pattern of the school boys and girls based on their weight and height measurements is presented in Figures 11a,b. The figures also include the growth pattern based on weight and height standards of the National Centre for Health Statistics (NCHS 1983).

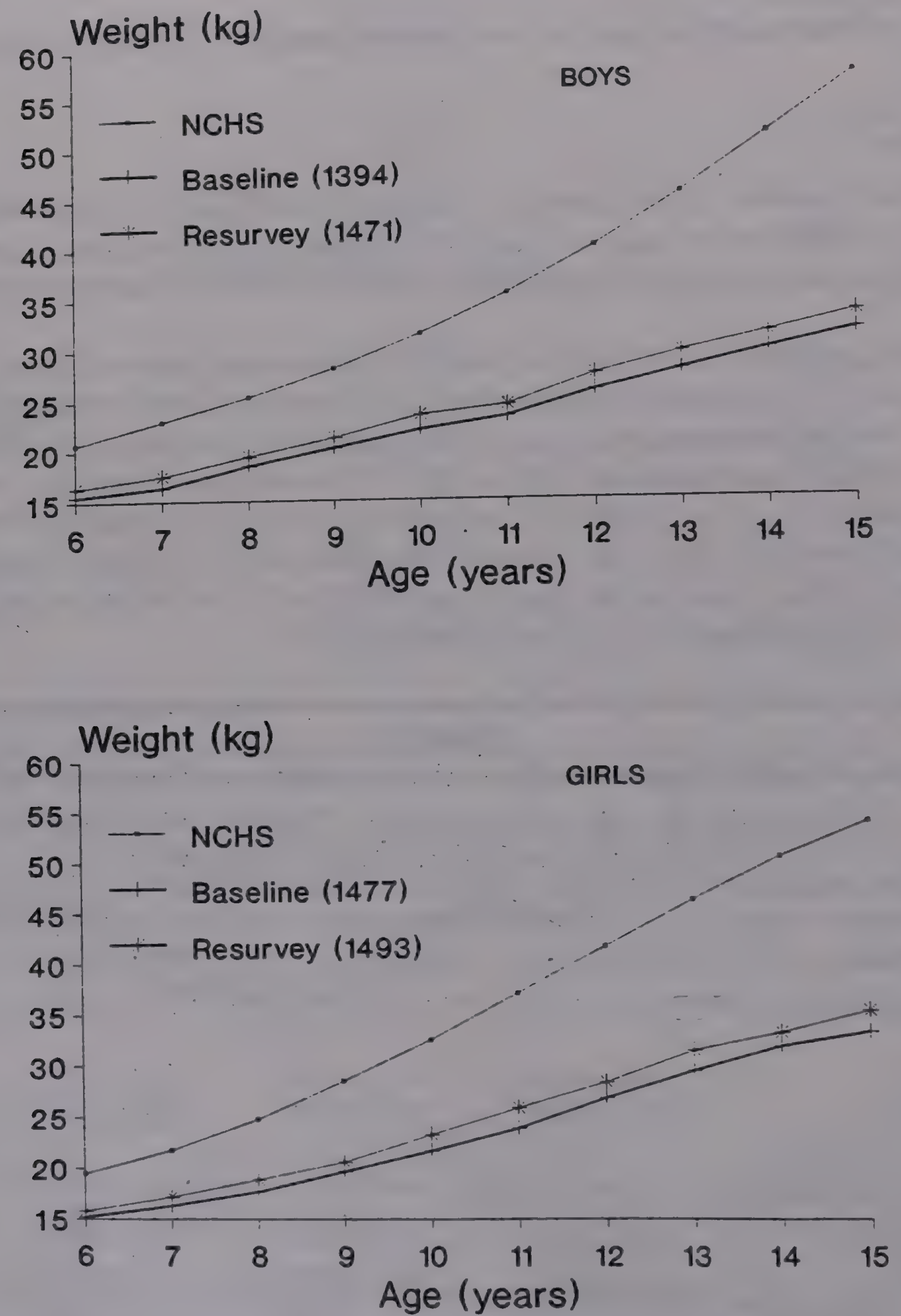
At each age group, the weight and height of schoolers improved from that recorded at the Baseline survey. Consequently the Resurvey-growth-curves shifted towards the corresponding NCHS curve. **The improvement was more pronounced for the older (11-15 years) than the younger (6-10 years) age schoolers**. The weight of the older age schoolers increased by 1 to 2 kg and height by 2 to 3 cm while the corresponding values for younger schoolers were 1 kg and 1 to 2 cm (Table 31). This was surprising because relatively larger proportion of younger than older schoolers had received the health inputs (Table 10) which improved their appetite as stated by the schoolers themselves (to be discussed later).

Table 31
Impact of health inputs on the mean weight and height of schoolers (6-15 years) by age group in the Baseline and Resurvey covering the three study districts

Age groups	Weight (kg)		Height (cm)	
	Boys	Girls	Boys	Girls
	Mean ± SEM			
6 - 10 years				
Baseline (B)	18.5 ± 0.43	18.1 ± 0.20	117.0 ± 0.49	116.0 ± 0.51
Resurvey (R)	19.6 ± 0.21	19.2 ± 0.19	119.1 ± 0.47	117.9 ± 0.43
Change (R - B)	1.1	1.1	2.1	1.9
11 - 15 years				
Baseline (B)	27.5 ± 0.44	29.0 ± 0.49	138.8 ± 0.76	139.5 ± 0.89
Resurvey (R)	29.1 ± 0.59	30.8 ± 0.68	141.1 ± 0.94	141.7 ± 0.94
Change (R - B)	1.6	1.8	2.3	2.2

Figure : 11a

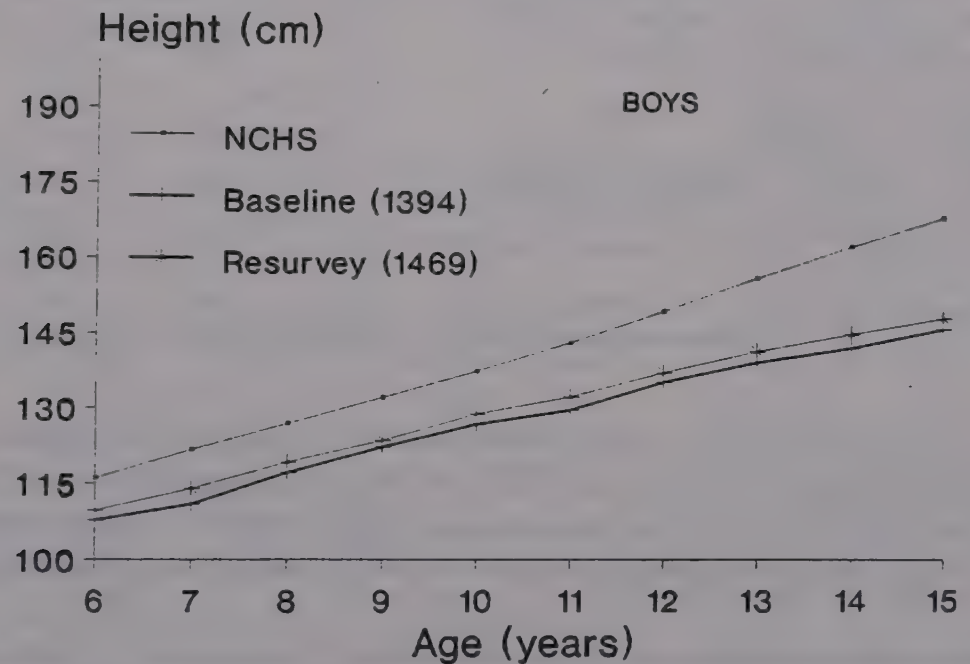
Growth pattern of schoolers (6-15 years) by weight-for-age in the Baseline and Resurvey covering the three study districts

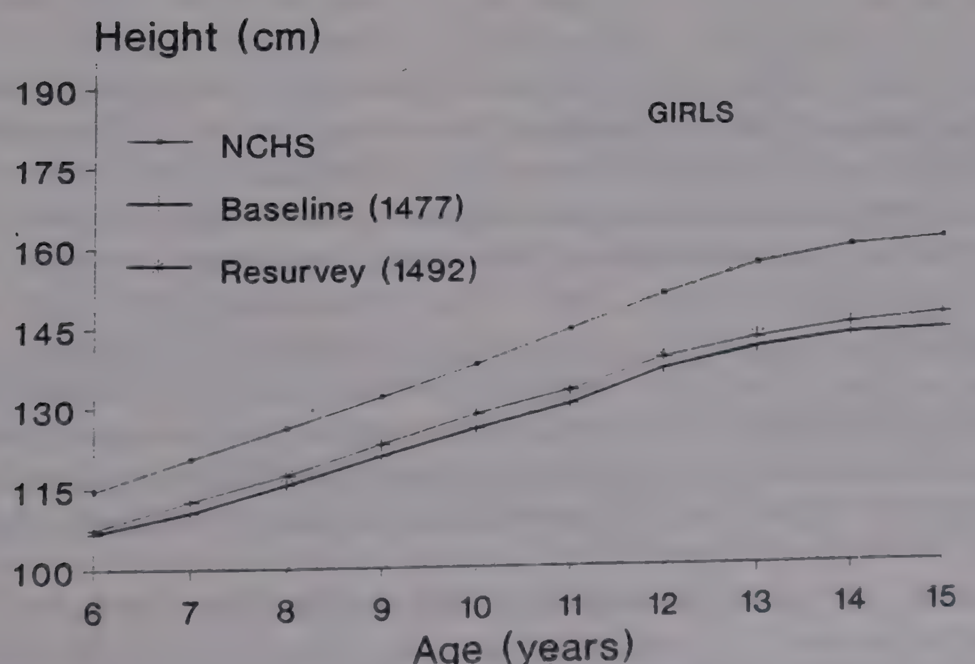


Figures in parentheses denote sample size

Figure : 11b

Growth pattern of schooler (6-15 years) by height-for-age in the Baseline and Resurvey covering the three study districts





Figures in parentheses denote sample size

Although the growth curves based on weight (Figure 11a) and height (Figure 11b) measurements recorded at the Resurvey were closer to the corresponding NCHS curves, the gap between the former and the latter widened as the age advanced indicating progressive increase in the degree of malnutrition. At the Baseline survey, the mean weight of 6 year old boys was 75% and among the girls was 78% of their respective standard weights, while at 15 years of age the mean weight of boys dropped to 55% and that of girls to 62% (Table 32).

Table 32

Impact of health inputs on the mean weight and height as percent of NCHS standards of 6 and 15 years age school boys as well as girls in the Baseline and Resurvey covering the three study districts

Age	Baseline		Resurvey	
	Boys	Girls	Boys	Girls
Weight % NCHS				
6 years	75	78	79	81
15 years	55	62	58	68
Height % NCHS				
6 years	93	93	94	94
15 years	87	89	88	91

Similar trends were observed in height measurements. At 6 years of age the height of boys and girls was 93% of the NCHS standards while at 15 years of age it reduced to 87% for boys and 89% for girls (Table 32). However regardless of these trends there were improvements in weight and height expressed as percent standards from the Baseline survey to Resurvey.

Generally, growth failure begins to set in when energy expenditure is not adequately replenished. The under-privileged schoolers expend a large amount of energy as they begin to shoulder responsibilities of household chores from the tender age of 6 years. Nayar (1991) had reported that children put in 4 to 8 hours of work daily by the age of 10 to 14 years and their work hours increase as they grow. In the present study as discussed earlier, 20% children were doing 2 to more than 4 hours of physical work daily (Table 2). The nutrient intake of those children who are required to participate in household chores at that young age, generally remains grossly inadequate as compared to the daily recommended allowances (ICMR 1992). Besides it is known that inadequate diet intake and unhygienic environment exist synergistically. Insanitary environment causes infections. Infections in turn, tend to aggravate dietary inadequacies, the net result being growth retardation (Gopalan 1992). This phenomenon might explain growth retardation of a higher degree in older versus younger age schoolers in the present evaluation. Also because in a similar group of schoolers regardless of their age and sex, **the nutrient intake was below 65% for calories and protein (except among the 6-10 years age schoolers) and below 40% for vitamin A and iron (Sentinel Study Report 1995)**. Thus it appears that nutrient inadequacy was perhaps the major cause of growth retardation seen in the study population.

Table 33 shows the total weight and height gains over the age period of 6 to 15 years, at the Baseline survey and at the Resurvey. The gains were higher at the Resurvey than at the Baseline survey (18.0 vs 16.8 kg weight, 39.4 vs 38.1 cm height). But the gains remained markedly lower as compared to those of under-privileged Indian children (Vijayraghavan et al 1971). Earlier Kanani (1984) had also

reported similar results. **This indicates that the under-privileged schooler of Gujarat requires all out assistance in the improvement of his/her nutritional status. This has been easily achieved in Gujarat's improved MDMP.**

Table 33

Impact of health inputs on the total weight and height gain from 6 to 15 years by schoolers of the present evaluation as compared with published data

	Total weight gain (kg)			Total height gain (cm)		
	Boys	Girls	*	Boys	Girls	*
Present evaluation :						
At Baseline	15.7	18.0	16.9	38.7	37.6	38.1
At Resurvey	16.7	19.4	18.0	39.0	39.9	39.4
Underprivileged Indian children Vijayaraghavan et al (1971)	23.3	20.8	22.0	47.0	42.2	44.6
Kanani (1984) (Age range 5-15 yrs)	12.7	14.3	13.5	37.6	35.7	36.6

* Combined

(2) Impact of the health inputs on the nutritional status of the schooler

Since Body Mass Index (BMI) is a measure of body weight in relation to height and it is considered to be a more accurate measurement for the evaluation of the nutritional status of children (Rao and Singh 1970, NIN 1974b), BMI was calculated for the 6 to 10 years; and the 11 to 15 years age groups of schoolers. A BMI less than 13.0 was considered as indicative of undernutrition, between 13.0 to 15.0 as indicative of moderate malnutrition and above 15.0 as indicative of normal nutritional status (Rao and Singh 1970).

In both the age groups, more schoolers were in the normal (12% vs 17% in the 6 to 10 year and 34% to 25% in 11 to 15 year-olds) and less in undernourished (27% vs 37% in the 6 to 10 year and 14% to 17% in the 11 to 15 year-olds) categories at the Resurvey than at the Baseline survey (Figure 12). **These findings suggested that nutritional status (as assessed by BMI) of the schoolers significantly improved in response to the health inputs.**

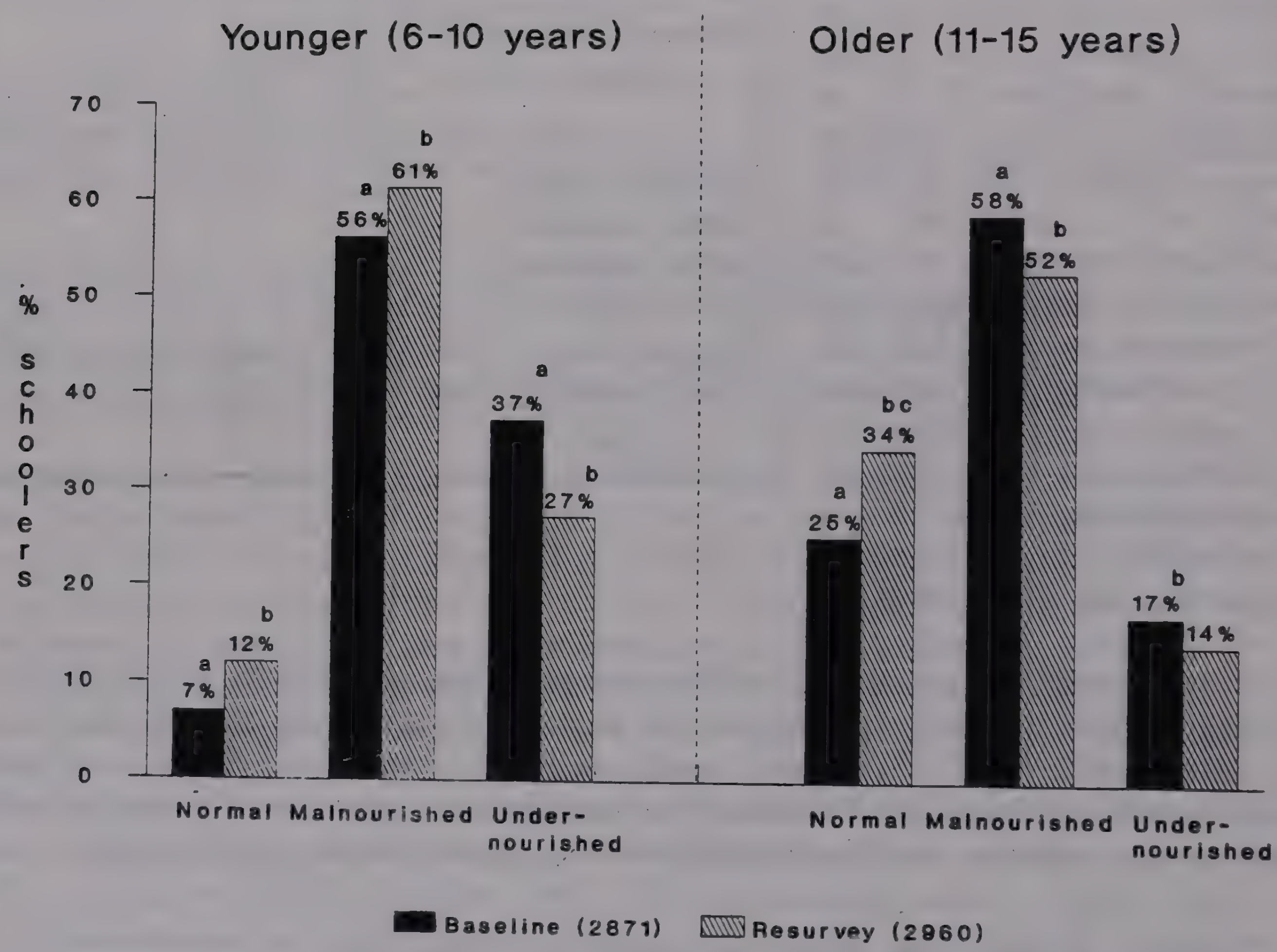
(3) Impact of the health inputs on the height-for-age index of the schooler

Height in relation to age compared to the standard is regarded as a measure of nutritional status over a long period (Waterlow 1972). According to the height-for-age index however, the nutritional status of the schoolers did not improve from the Baseline survey to the Resurvey in the younger (6 to 10 years) as well as older (11 to 15 years) age schoolers. Stunting was higher in the older than among the younger schoolers (Figure 13).

Stunting is considered a poverty syndrome; poverty means poor income and thereby inadequate diet intake. In the present study as discussed earlier, the nutrient intake of the schoolers was highly inadequate as per their daily recommended allowances. Thus regardless of 1 to 3 cms increase in height from the Baseline survey to the Resurvey, the schoolers did not

Figure 12

Nutritional status by Body Mass Index of schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts



Figures in parentheses denote sample size

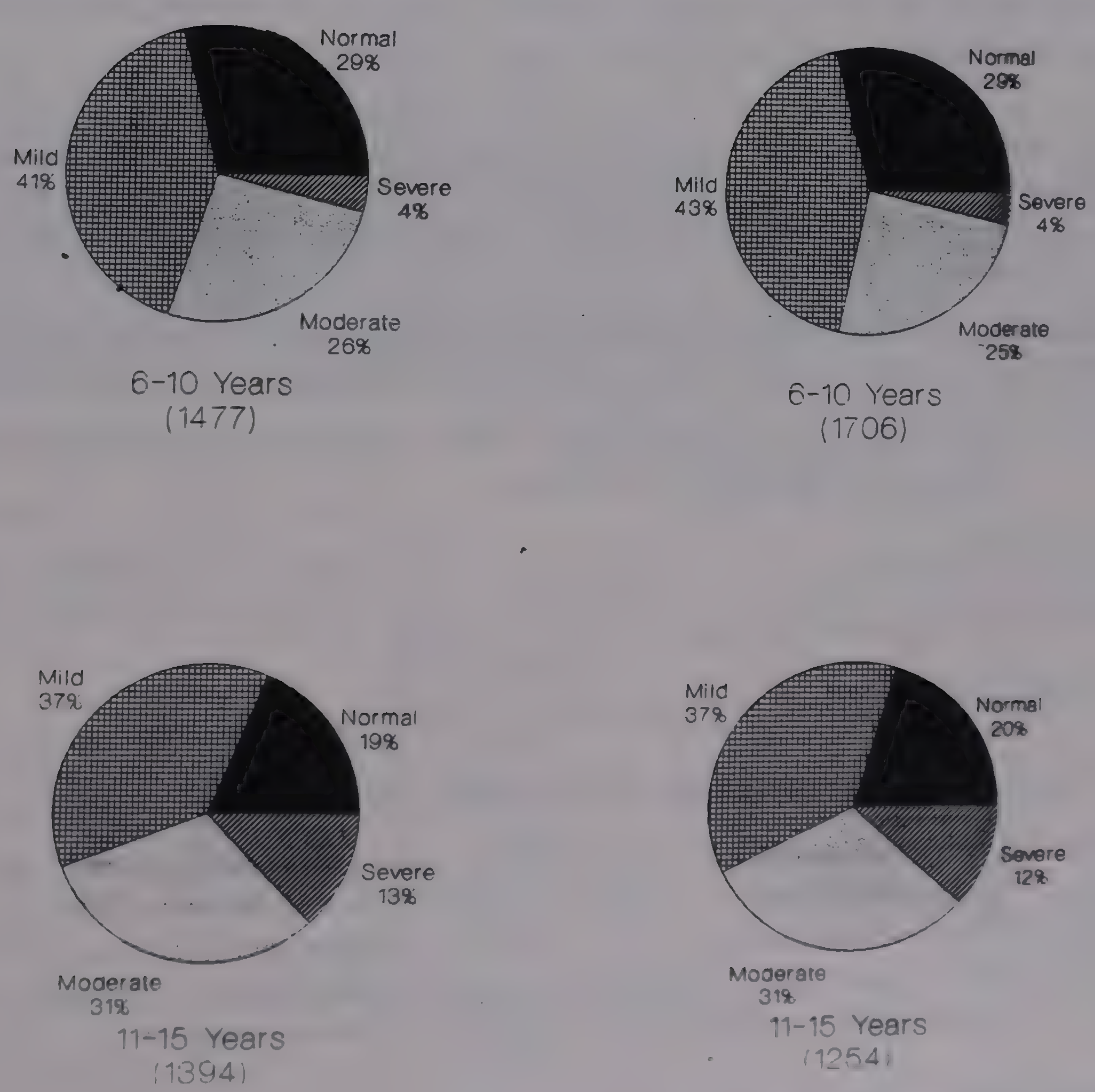
Figures under each head having different superscript between surveys are significantly different from each other.

Figures under same head having different superscript between 'younger' and 'older' are significantly different from each other

Figure 13

Height-for-age index (Waterlow 1972) of schoolers (6-15 years) in the Baseline and Resurvey covering the three study districts

Baseline **Resurvey**



Figures in parentheses denote sample size

reach the expected height for their age. Hence their nutritional status when expressed on the basis of height-for-age index, showed no marked improvements.

Delay in the adolescent spurt could yet be another reason for these findings. Because Tanner (1970) had reported that a hostile environment and an inadequate food intake causes delay in the adolescent spurt in both male and female children.

In conclusion from the Baseline survey to the Resurvey, (a) the growth of the schoolers improved by 1 to 2 kg weight and 1 to 3 cm height, and (b) according to Body Mass Index more schoolers were in the normal category (12% vs 7% in the younger age and 34% vs 25% in the older age).

(4) Programme Implications

1. **One of the major objectives of the MDMP is to improve the nutritional status of the schooler. Our evaluation has shown that there was notable and significant increase in the growth curves for weight and height. A larger proportion of schoolers also had a Body Mass Index of > 15. Our data show that the iron, vitamin A supplementation and the deworming helped to achieve this. In programme terms, therefore, it is imperative to include albendazole, iron and vitamin A into the ongoing MDMP.**
2. **Although we did not assess the impact of iodine supplementation (through the fortified salt used in the cooked meal), it is now known that practically the whole of India is endemic for IDD disorders. Hence, iodine should also be included in the programme package.**
3. **The school teachers or a School Health Cell should monitor the Growth of the Schoolers.**

SECTION EIGHT : PERCEIVED BENEFITS BY THE SCHOOLERS REGARDING THE SCHOOL HEALTH PACKAGE

Section eight includes :

(1) Physical fitness : an overall impact of the health inputs

(2) Programme implications

(1) Physical fitness : an overall impact of the health inputs

The schoolers who had received the health inputs were asked six to nine months later, about their present 'physical fitness' in comparison to what it was before taking the health inputs. The 'physical fitness' was defined as any one or combinations of : being more active and energetic; being able to study well; and play well without being tired; fell ill less frequently; ate more food/felt improvement in appetite; and came to school more regularly.

It was heartening to note that overall 73% schoolers felt better than before (Table 34). The remaining 27% however felt no change in their physical fitness. **Of those who perceived improvement in their physical fitness, over 50% said they felt more energetic, active and hence were able to study well and work well. Similarly above 40% stated 'they fell ill less frequently, could play well and did not**

feel tired all the time like before. One-fourth of them claimed to be eating more than the amount they ate before taking the health inputs. Coming to school more regularly than before was however mentioned by only 5% schoolers. This was understandable because school attendance in the preceding one year was between 71% to 100% at the Baseline survey as well as at the Resurvey (Table 35) for a larger proportion (between 75 to 85%) of the younger (6-10 years) and the older (11-15 years) schoolers. Schoolers (about 10-20%) who were round worm infected, spontaneously mentioned being worm free at the Resurvey.

These findings appeared to be the ultimate consequence of the decreases observed in intestinal parasitic infections and in vitamin A deficiency ocular signs, and improvements recorded in haemoglobin levels and in growth as a result of the school health package programme. They support the need for implementation of the health package programme in other States and Union Territories of the country.

Another positive and extremely important outcome was the student's eagerness to participate in the 'health package programme'. They voluntarily asked the implementors to give them the health inputs (Personal communication with the implementors 1995).

Table 34
Impact of health inputs on the schooler's (6-15 years) rating about the improvement in his/her physical well being following participation in the school based health package in the three study districts

Benefits	Total children (2218)	
	N	%
Feel better than before	1622	73[a]
Feel active/Energetic	1231	55
Can study well/work well	1187	53
Can play well/Don't feel tired	1005	45
Fall ill less frequently	906	41
Improvement in appetite/Eat more food	513	23
Come to school more regularly	103	5
Feel the same as before	596	27[b]

Feel better = A minimum of one positive response
Figure in parentheses denote sample size
Figures having different superscript in the same column are significantly different from each other

Table 35
Impact of health inputs on the school attendance of school (6-15 years) schoolers as percent of total working days in the school year in the Baseline and Resurvey covering the three study districts

Age groups	Baseline		Resurvey	
	N	%	N	%
6-10 years				
Percent Attendance				
<= 60	133	11	113	8
61-70	141	11	184	13
71-80	320	26	357	25
81-100	650	52	748	53
Total	1244	100	1402	100
11-15 year				
<= 60	64	5	93	8
61-70	134	10	135	12
71-80	318	24	260	22
81-100	791	61	685	58

(2) Programme Implications

1. In programme terms unless the Receivers (Schoolers) see a real and concrete benefit in an intervention, it will *not* work. By way of contrast to the schoolers having a rather vague opinion of the MDM (Section One), they were able to see concrete gains in the tablets/capsules consumed by them in terms of their physical fitness, increased energy/ activity levels, ability to study better, less tiredness, better appetite, freedom from worms etc. Such real or perceived benefits can and should be capitalized upon in IEC programmes beamed at them, their parents, their teachers, their panchayats, and their communities.

Chapter Five

SUMMARY AND CONCLUSIONS

Two rounds of surveys, the Baseline and the Resurvey (6-9 months after implementation of the health package programme by the Government of Gujarat (GOG) were carried out in three purposively selected districts of Gujarat State. From each district, one Urban and two Rural-Talukas were randomly selected.

The data presented in this report pertain to 2872 and 2964 primary schoolers (6-15 years) at the Baseline surveys and at the Resurvey respectively. The schoolers were randomly selected from six schools in three Urban-Talukas (two in each Taluka) and twenty-four schools (12 schools each from less than or above 50 km distance from their respective Taluka headquarter) from the six Rural-Talukas (eight schools per Taluka). In all there were 30 schools, 10 schools per district.

Data were collected by trained investigators with the help of pretested and precoded questionnaires. Blood sample collection for haemoglobin estimations and clinical examination were done by a medical doctor. Haemoglobin estimations were done by a pathologist.

School Health Package

The School Health Package was implemented by the GOG. The health inputs integrated into the ongoing Mid-Day-Meal Programme consisted of a six monthly dose (400 mg) of albendazole and vitamin A (200,000 IU), and one tablet daily of ferrous sulphate providing 60 mg elemental iron for 85 days per term x 2 terms in a year.

Schooler's participation : On an average 72% schoolers participated in the health inputs programme; 95% of those who were aware of the programme stated that they would willingly accept the health inputs.

Logistical delivery of the health inputs : According to the Implementors the logistical delivery of the Health Inputs to the schools was 100%. They also claimed that the coverage of Urban schoolers was 94% to 100% and that of Rural schoolers was 42% to 94%.

Receipt of the health inputs : As claimed by the schoolers, 71% to 79% of Urban and 50% to 67% Rural sectors had received the health inputs. Caste consciousness and distance between a Taluka headquarter and the school did not affect the implementation of the programme. More of the younger (6-10 years) than the older (11-15 years) age schoolers had received the health inputs.

Impact of the health inputs on the prevalence of intestinal parasitic infections : The prevalence of intestinal parasitic infections as perceived by the schoolers significantly reduced from 40% to 32% in response to the health inputs. These findings are supported by the stool examination conducted on a sub-group of schoolers where the prevalence was 71% in those who had not received the health inputs and 40% in those who had, estimating to a reduction of 31%.

Impact of the health inputs on haemoglobin (Hb) status : The mean haemoglobin levels of schoolers significantly improved by 1.2 g/dl from 10.7±0.04 to 11.9±0.04 g/dl in boys and 10.5±0.04 to 11.7±0.04 g/dl in girls in response to the health inputs. Consequently the prevalence of iron-deficiency anaemia (IDA) significantly reduced from the Baseline survey to the Resurvey (84% to 53%). A significantly smaller proportion of iron-deficient and non iron-deficient schoolers exhibited xerophthalmia at the Resurvey (4.8% and 4.1% respectively) than at the Baseline survey (9.6% and 5.8% respectively). Likewise a smaller proportion of iron-deficient (49% vs 51%) and non iron-deficient (55% vs 52%) were morbid with diarrhoea/dysentery/upper respiratory tract infections at the Resurvey than at the Baseline survey.

Impact of the health inputs on vitamin A deficiency ocular signs : Prevalence of vitamin A deficiency ocular signs significantly decreased from 48% to 22%. The reductions were recorded in younger (6 to 10 years) as well as older (11 to 15 years) age schoolers.

Impact of the health inputs on growth : Growth improved significantly. The weight-for-age and height-for-age curves of the schoolers at the Resurvey were closer to the curves based on the NCHS standard than those at the Baseline survey. Also more schoolers were nutritionally in the normal category by Body Mass Index (BMI >15.0) at the Resurvey (12% and 34% in the 6 to 10 years and 11 to 15 years age group respectively) than at the Baseline survey (7% and 25% in the 6 to 10 years and 11 to 15 years age groups respectively).

Impact of the health inputs on morbidity status : Significant reductions from the Baseline values were recorded in diarrhoeal cases in xerophthalmic (23% to 15%) and non-xerophthalmic schoolers (22% to 11%). Upper respiratory tract infections reduced non-significantly in xerophthalmics (79% to 70%) but tended to increase in non-xerophthalmics (59% to 67%).

Perceived benefits by the schoolers : Above 70% schoolers perceived that they felt physically more fit than before (more active/energetic; could study and play well, etc) after taking the health inputs. This in a way could be considered as an acid test for the school health package programme.

We would like to restate that these findings are not of a controlled research study but are the outcomes of an evaluation of a programme implemented by the Government of Gujarat. We as an evaluator had no role in the implementation of the programme. Considering this, we feel happy to conclude that the programme has achieved what it intended to. It needs to be taken to other States where the MDM is in operation or not.

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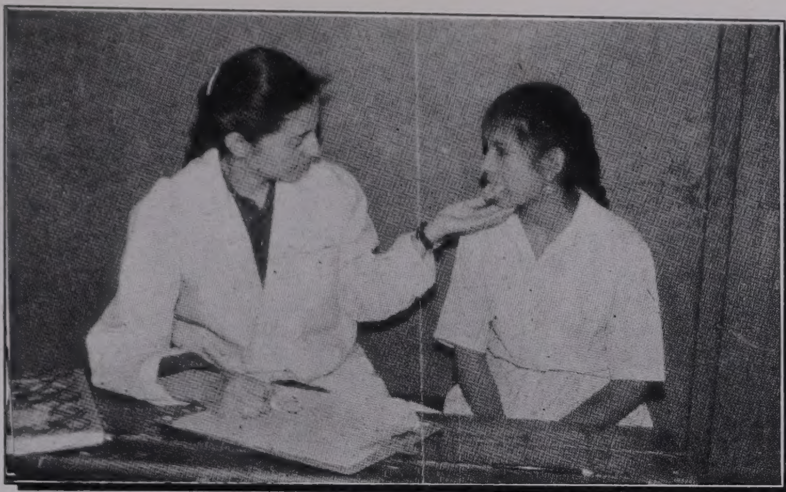
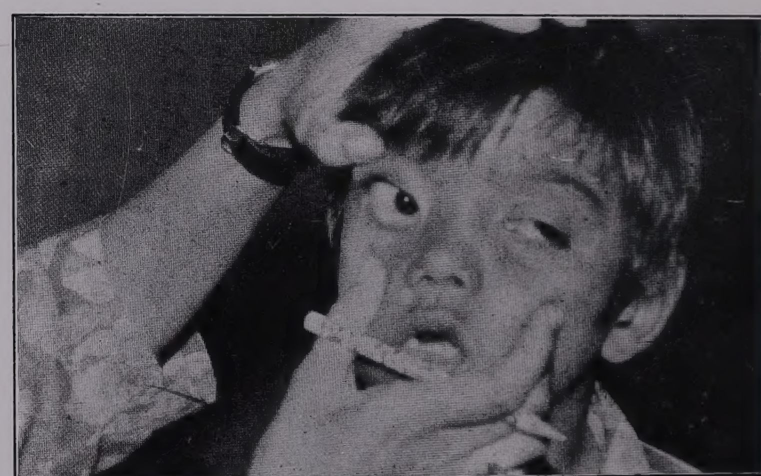
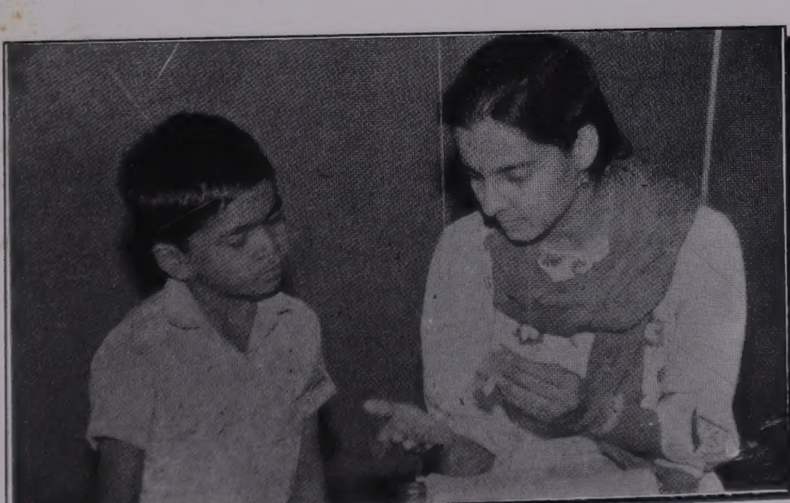


Clinical assessment for Iron Deficiency Anaemia (IDA)



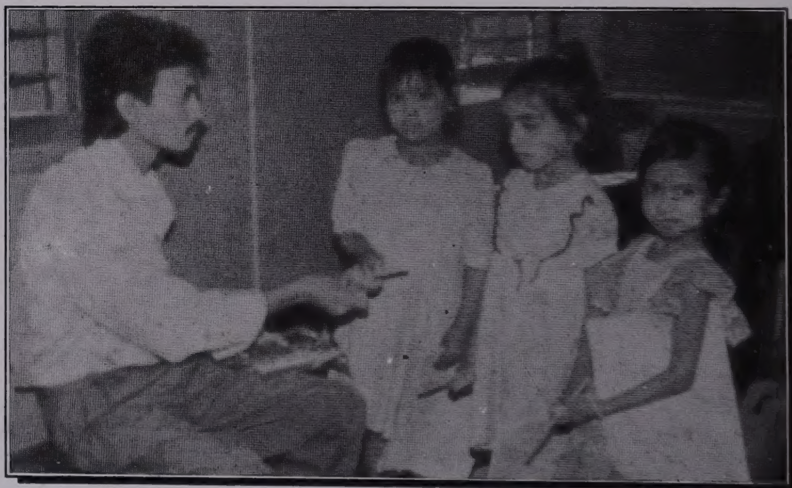
Clinical assessment for ocular signs of Vitamin A Deficiency (VAD)



Schooler's recall of tablets received

TCS evaluation team interacting
with the school staff

TCS evaluation team interacting with the parents



Small incentive given for the schooler's
cooperation in the evaluation

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